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An Experience With Manganese in Textile Water

Troubles in Boiling and Bleaching—Laundry Difficulties—Makeshift Remedies—Large Scale Purification —The Occurrence and Usual Behavior of Manganese in Water Supplies.

By CHARLES F. GOLDTHWAIT

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MANGANESE in the water seems to be a more frequent cause of trouble than is commonly supposed, but there is not a very great literature on the subject, with respect to either city supplies or industrial waters.

Several years ago a sudden increase in the amount of manganese in the Baltimore, Md., city water gave the writer one of his most troublesome textile problems. It suddenly appeared during the bleaching of cotton skein yarn in open tubs, and the first observation of anything out of the ordinary was the formation, or apparent formation, of brown stains all over the yarn in the sulphuric acid sour, a part of the process where stains are more likely to disappear than to become more prominent.

The beach-tub proper contained a standing bath of "chemic" and stains formed at that point, although not to a great extent. It was soon found, however, that the worst trouble appeared in the first cold water wash, as the skeins were transferred almost dripping wet from the fairly strong bleach solution to water fresh from the city mains. Frequently the submerged portion of the skeins as they hung on the sticks turned completely brown and the water also took on a brown color.

The stains were of a duller color than those formed from iron and at once suggested manganese, perhaps in the bleaching powder where it is sometimes found. This explanation, however, did not seem sufficient, and a visit to the city filtration plant revealed that there was a small amount of manganese in the city water, commonly not over 0.2 parts to a million.

It was found, as would be expected, that sulphuric acid alone was not sufficiently effective in removing the stains but that the yarn could be cleared by warm hyposulphite or by a bisulphite "antichlor." For example, in one case yarn completely bleached and washed was left hanging in an empty tub overnight. In the morning it was completely brown and the color would not come out with sour alone.

The brown stain was nothing more or less than a light manganese bronze, and it was produced on the same principle although not in exactly the same manner as the commercial shade. It was the result of the precipitation of manganese by alkali and its oxidation by an alkaline oxidizing agent, calcium hypochlorite, to the brown form of oxide. This is theoretically manganese dioxide, but in actual experience it is more likely some hydrated or intermediate form of mixture, which may assume colloidal properties.

Temporary Remedies

Since this condition of the water was regarded as temporary, for bleaching had been conducted for some months previously without trouble, it did not seem necessary to go to the expense of installing water purifying equipment. However, it did seem better to try to avoid the stains than to allow the discoloration to take place and to depend on removing it afterwards. Since the yarn was clear coming from the bleach-tub, this was accomplished by preparing the first wash water half or three-quarters of an hour ahead, by putting into it several gallons of 3 deg. Tw. bleach liquor. The water turned brown from the oxide formed in suspension in it, and the bleached yarn even though put into the brown water came out clear. A canvas lining in the tub and the string used to pull the plug were permanently as brown as one's hands when cleaning them with permanganate. Evidently the first wash reduced the concentration of free alkali and oxidizing agent to so low a point that there was not

sufficient of these reagents present to cause much staining in subsequent washes, or not time enough for them to act.

As assurance that the manganese was removed from the yarn as completely as possible, particular care was given to the antichlor treatment. Whenever yarn in process was to be stored overnight, care was taken to leave it on the "acid side" or in a "reduced" condition from the antichlor, and covered to avoid too much exposure to oxidation from the air and drying-out; also, at times, hydroextracted to remove the surplus of manganese-containing water.

Kier-Boiling Troubles

It was surprising to see a lot now and then tinted much browner than in the gray come out sufficiently white. By observing these simple precautions, the required amount of bleaching was done in a fairly satisfactory manner until the trouble disappeared.

Previous to the manganese difficulties in the bleaching paper, the writer had experienced an extremely troublesome form of kier stains. There were no facilities for making a chemical study of them, and consultation of the literature and of individuals with experience in kier boiling failed to give any clue to the real cause. This difficulty appeared first as a peculiar brown stain where yarn was boiled with 1 per cent on the goods, of caustic. It showed especially wherever there was evidence of channelling or of a little more flow of liquor, as though something had filtered out. Increasing the amount of caustic up to 3 per cent simply made a proportional increase in the stains both in number and depth of color. Various kinds of assistants were tried, proprietary articles and separate chemicals, silicate, trisodium phosphate and oils. In general, the result of these additions was a precipitation of the hardness of the water and its filtration by the yarn mainly around the sides of the kier, giving not only stains but heavy deposits of solid material.

The stains often persisted through skein mercerizing and showed in the yarn if it was left natural. If it was bleached the last remnants which survived the sour disappeared in a warm antichlor.

The best results were obtained with a mild straight soda ash boil. It was sufficient for wetting-out yarn for mercerizing, but was, of course, hardly adequate for the best bleaching.

A few of the stains were preserved and tested at a later date when a laboratory was available and they were found to contain managanese. Curiously enough, some of the worst—that is, brownest—stains from caustic boils showed very little ash and but little manganese. The indications are, however, that the manganese, which seemed to precipitate to a greater extent with more caustic, had filtered out and held some of the colored organic matter from the kier liquor. These stains could be rather easily washed out by hand when fresh, but not so readily after being on the wet yarn for two or three days. In the other cases the manganese came down with the other hardness constituents. Whatever the exact mechanism, there is no doubt that the manganese contributed to the kier-boiling troubles, as well as to those of the laundries and housewives of the city, as mentioned later.

While the writer had no spare tanks to try it out, the obvious remedy for temporary use would be to boil all the water for the kier charge with the chemicals to be used, or other softening materials, and to either settle or to filter before allowing it to come into contact with the goods to be boiled. No doubt, however, each water containing manganese will be a rather specific problem.

Where the Manganese Came From

The story of what happened to the water supply is in some respects more interesting than the textile difficulties that it caused. A very complete account has been given by John Baylis, then Principal Sanitary Chemist at the Montebello Filters, Baltimore. An increase in the manganese content was detected as the cause of an interference with the ortho-toluidine test for residual chlorine. The source of the manganese was found to be the rock underlying the reservoir, part of which covered newly flooded land. Conditions arose which favored biological actions that form organic acids, at the same time with a shortage of dissolved oxygen at the reservoir bottom. Both of these conditions are favorable to the solution of manganese, which normally precipitates in contact with the air and deposits on the way to the filters and to some extent beyond them in the water system.

The final result was that some unusual biological condition prevented the manganese that was coming from the rock from being deposited, and at the same time brought back into solution much that was already precipitated in the reservoir, tunnel and filters. The production of acids that will dissolve manganese is probably limited to a few species of bacteria as it seems to occur only at certain times of the year.

Baylis expresses a belief based on his extensive studies of the subject, that there are no bacteria to whose life iron or manganese are essential. Water containing these elements usually contains considerable organic matter which may serve as food, and the fact may be that certain species live on this food and can exist in the presence of iron and manganese while other species cannot. Certain organisms have been associated closely enough in the past with the elements manganese and iron to have been called manganese or iron bacteria.

The explanation of the source of the trouble shows why it has been impossible to state the amounts of manganese or to specify definite amounts of correc-

tives. The manganese was not constant and it was therefore necessary to use an excess of bleach to correct the water. Usually the water was drawn clear, but in a few instances it came brown and turbid from the city line, apparently from the loosening of deposits in the pipes.

The writer was the first to experience trouble and to call it to the attention of the authorities. Soon afterward some of the laundries began to get discolorations and stains, and there was complaint from households and hospitals. So far as known the laundries were fairly successful in keeping their work clear with bisulphite of soda, oxalic acid or suitable proprietary compounds.

The use of glucose in soap or alkaline baths is supposed to have a reducing effect on manganese and to assist in holding manganese as well as iron in colloidal suspension and prevent staining. The writer tried it in a few kier-boils, but was unable to assign any beneficial effect to it.

Manganese and iron form compounds with zeolite softening agents that are not regenerated by the usual treatment with salt. One laundryman in Baltimore reported that he had no trouble with the manganese, but it spoiled the zeolite in his softening system. There is, however, a zeolite that is especially adapted for treating waters containing manganese.

Removing Manganese from the City Supply

Owing to the large number of complaints, experiments were begun on removing the manganese at the city filters. It seemed doubtful if any element occurring to the extent of about one part per million could be successfully coagulated and precipitated without the aid of some other precipitant. Iron as ferrous sulphate was therefore tried as a coagulant and the manganese was found to come down with it (that is, with ferrous hydroxide), although it would not with alum. During a two or three week run with iron and lime the whole water supply was freed from manganese at the filters, and the present writer found that there were fewer stains in both boiling and bleaching. Such stains as occurred during this time no doubt came from the water that had previously passed the filter or from manganese deposits in the pipes.

In order to round out the discussion and make it as useful as possible a little information is included from other sources.

Professor Olney has told the writer that the Lowell city water derived from driven wells contains manganese and has caused trouble at times. In more recent years a special plant has been installed employing aeration and filtration through coke, which has proved fairly efficient in removing it. This water, however is not used extensively for industrial purposes.

Staining and Other Troubles

Kneeland describes some of the troubles observed with a water containing 1.5 to 2 parts per million of manganese, a total hardness of 190, but only a trace of iron. A large share of the manganese precipitated and collected in the mains and service pipes, sometimes choking them entirely, leaving from 0.6 to 0.8 p.p.m., which is enough to cause trouble in home laundries, still dissolved in the water. The usual staining from precipitation by alkalies was experienced. A peculiarity was that clothes which had been quickly dried out of doors gave no trouble, while if they dried slowly or were rolled up damp, a brown discoloration appeared, often after an hour or two.

An unusual remedy was recommended, depending upon the fact that manganese hydroxide is soluble in most of the ammonium salts. A pound of ammonium chloride in sufficient water to half fill a common wash-boiler will remove all the stains if boiled for ten minutes. A half pound dissolved in the first hot rinse keeps the manganese hydrate in solution so that it is washed out, and stains are prevented. Owing to the harmless nature of ammonium chloride, this experience may be suggestive for technical use.

Baylis and Kneeland both indicate indirectly that manganese staining acts as a good test for cleanness of washed garments, for the stains were more inclined to show where there had been greasy spots or where the articles had been most in contact with the body.

In Baltimore, troubles were avoided by using the less alkaline washing compounds and keeping the baths on the acid side as far as possible. There was less trouble in home laundering, perhaps owing to the use of milder agents. White enameled water fixtures were also stained, but mostly in kitchens where there was contact with grease.

Applebaum suggests that manganese troubles are undoubtedly often reported as iron troubles difficult to cure. His article is a summary of German experiences. Manganese is a common element in the upper soil layers and as a rule is found in all ground waters containing considerable amounts of iron, but there are waters in which there is little iron and much manganese. The elements are closely akin and are found in similar compounds, for example the bicarbonate or sulphate. They are usually insoluble in the soil but under the influence of carbon-dioxide or hydrogen sulphide from organic matters they are transformed into the soluble forms. The sulphate is more difficult to remove.

Troubles with microscopic organisms which produce fibrous gelatinous masses in the pipe lines may be due to manganese as well as to iron. Not only are the conduits rendered less effective, but the brown deposits may break loose and come through in the water.

As little as one-half part per million may be decidedly injurious in technical work, giving brown stains or poor whites in laundries, bleacheries or paper mills.

When present as bicarbonate and accompanied by a large amount of iron, the manganese can be removed by aeration and filtration. This does not remove the manganese if it is present as the sulphate, or if the water is free from iron, nor does it remove it completely even under the most favorable conditions. Aeration and filtration, followed by the addition of lime, has been employed but is rather complicated. Other methods have utilized permanganate or ozone as oxidizing agents, also electrolysis. The zeolite for manganese is claimed to remove it, whatever its form in the water.

Possible After-Effects in Processed Goods

The writer did not hear of any objectionable after effects from manganese remaining in any of the bleached yarn, but Heerman has stated that even in traces it can, on account of its catalytic activity, bring about damage in goods in further processes or even after finishing. The curious observation might be mentioned here that light brown stains that still showed in yarn after bleaching sometimes disappeared after exposure to the air. In one case a couple of skeins of wet bleached yarn were laid aside at night for attention in the morning, but in the morning the stains had simply disappeared although manganese undoubtedly remained.

The possibility of catalytic action has recently been brought up in a more definite form. In rubber proofing it is found that a most fruitful source of trouble is the presence in the cloth of minute quantities of metals which have the property of causing accelerated oxidation and degradation of the rubber. The most common and the worst is copper, and rather rarely, manganese. Cloth containing a hundredth of 1 per cent or more copper is considered worthless for proofing. Manganese is not as reactive and the limiting quantity was not given, but the permanganate bleaching process, for instance, is not advisable for this work. If such is the case it is certain that manganese troubles such as the writer has experienced, would be equally disastrous, and it would seem advisable to consider the possibility of manganese being in the water before undertaking such work.

A curious application of this catalytic action was once proposed in the form of a bleaching process, the manganese serving as a sort of oxygen carrier in a kier to effect boiling and bleaching at the same time. To the kier liquor was added a manganese salt, and air was passed through the kier load. This was supposed to oxidize the manganese, which would in turn oxidize the impurities in the cotton. It would thus become reduced and would then be reoxidized by more air and continue the bleaching. It is interesting chemically, but apparently was never a commercial success.

Without attempting a complete bibliography, a few leads are here given on where to find information on manganese in water.

Several references to water and a note on the manganese bleaching process are to be found in the volumes of Applied Chemistry Reports of the Society of Chemical Industry.

Other references are:

Manganese in Baltimore Water Supply, John R. Baylis. Journal American Water Works Association, *12*, 211 (1924), which includes a very good bibliography.

Manganese in Laundry and Pipe Lines, H. C. Kneeland. Journal American Water Works Association, *13*, 436 (1925).

Iron and Manganese Troubles, Engr. and Contr., *65*, 169-172 (1926) C. A. *20*, 3052.

The Removal of Iron and Manganese from Water, R. S. Weston. Journal New England Water Works Association, 1914; Eng. News, *71*, 457-458.

Cloth Dyeing for Rubberproofing, Hockney and Bancroft, J.S.D.C., *43*, 107.

Essentials in Dyeing Cotton Warp Woolen Fabrics

Preparation of the Goods—The Make-up of Unions—Method of Dyeing—The Water Problem

By George Rice

THERE are two important essentials which ought not be overlooked when dyeing or bleaching the type of cotton warp woolen fabrics that the mills are manufacturing at the present time for the dress goods, drapery and automobile trimming trade. These essentials pertain to the character of the raw materials employed in the production of cloth, and, secondly, to the character of the water used in the dyeing or bleaching operations.

In dyeing almost any kind of cotton warp fabrics the object is to get a slightly darker shade on the warp than on the filling to avoid as much as possible the chances of the cotton showing through the woolen filling. Dyes are selected that have as nearly as possible equal coloring affinity for the cotton warp and the woolen filling. Where shading is necessary, as it usually is in union goods, dyes are chosen that will go well on the cotton in a cooling bath. The goods are prepared for dyeing by giving them a good scouring and rinsing to remove all oils, sizing substances, and foreign matters in general, and the dye bath prepared in an ordinary kettle provided with a winch which will operate steadily by means of a chain and sprocket drive. This latter item of driving the winch is mentioned because recently we saw a good grade of unions streaked and blotched at intervals due to the slipping of a winch belt drive that dragged the pieces irregularly through the liquor. The slipping was plainly visible but for some curious reason it was permitted to continue. It demonstrates that often an outsider going into a dyehouse, or any place where work is under way, will notice something that apparently is not observed by a regular attendant. We called the attention of the attendant to the slipping belt, and the young fellow said, "It has got used to running that way."

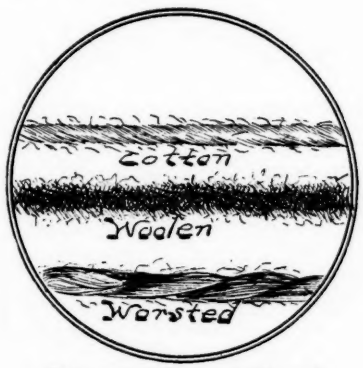
Presumably the head men of the plant who were accus-

tomed to having some of their pieces unevenly dyed day after day would rather overlook the trouble than order the belt tightened or substituted with a nonslipping drive. But the principal essentials we have in mind for this article concern the composition of the union pieces to be dyed, and the water used in the preparation of the dye.

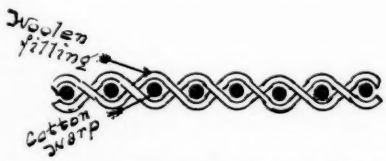
The Make-up of Unions

The normal union fabric is assumed to be cotton warp and woolen filling, but all dyers constantly are in receipt of union fabrics in which other materials enter, some of which are superior in physical and chemical structure to either wool or cotton, or the reverse. In this synthetic age there is likely to be any of the viscose products intermingled with the staple products. There may be true worm silk used for the production of fine hair-line effects in the cloth. Or a good or medium grade of worsted may constitute all or part of the filling for the purpose of assuring a luster on the face. In the lower grades of unions the filling yarns may be made up chiefly of shoddy, flocks, mungo, noil or similar remanufactured stock, much of which is suitable for the average union fabric, as modern methods of preparing reworked woolen stock guarantee evener and better yarn than in the old days when all kinds of decayed and inferior textile stock was ground up for shoddy. If the pieces to be dyed or bleached are just plain cotton warp and woolen filling the dyer can go ahead along the usual paths to get the colors. If the weaving has been properly done the woolen filling will cover the cotton warp and the latter will not be visible.

But other kinds of stock may be present. It is a good idea to examine the fibers or the threads with a glass. The physical construction of both fibers and threads are shown enlarged herewith.

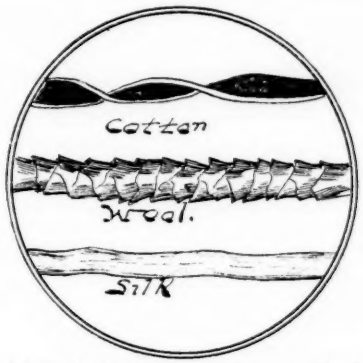


Enlarged Views of Threads



Section of Cotton Warp and Woolen Filling Fabric

Usually the cotton thread shows up round and smooth, the woolen appearing to be somewhat jumbled in its mass of fiber; yet this fiber is uniformly set and twisted, while the worsted thread has its long, lustrous filaments equally



Magnified Views of Cotton, Wool and Silk Fibers

stretched in a parallel order, thereby enabling it to reflect light well and shine.

Method of Dyeing

For use in garments the cotton warp woolen fabrics are on the market in colors of brown, gray, green, black and blue, and not many reds or yellows. For use as drapery the colors demanded would require a Paul Poiret or a Lucien Lelong, color and design couturiers of Paris, to correctly define, so varied and unique are the dazzling hues.

However, a dyer must get the color ordered, regardless of what he thinks of it. On the basis of 100 pounds of cotton warp woolen cloth use 200 gallons of water and 110 pounds of Glauber salts. The amount of dyestuff necessary to produce the shade is then added and the bath is brought to a boil, the washed pieces entered and run for about an hour without steam and about one hour with steam. Sampling begins at this stage and dyestuff is added if the color is too light, in which case further boiling is done and the process repeated until the proper shade is obtained on both the cotton and the wool.

The Water Problem

The water used in dyeing unions, or in dyeing almost any textile material, should be as soft as possible, a fact which all dyers and bleachers know too well.

The only thing the average dyer can do is to draw the water from the city hydrant, the yard well, the roof cistern, the near-by river or pond or from whatever place the supply comes from. He can soften the hard water, but softened water is not always so good as natural soft water, as the neutral salts employed tend to effect saponification. A dyer seldom has access to real pure water. Sea water contains chloride of sodium. River water holds carbonate of lime in solution, while most well waters

contain a quantity of soluble salts. We would like to have pure water, transparent, colorless, tasteless and odorless, as well as free from all substances held in mechanical suspension.

There are excellent compounds manufactured for clarifying the water supply for dyeing and bleaching purposes, the working of which is well understood by all dyers and bleachers and need not be described here.

Unless a dyer has some way of providing himself with plenty of soft water in dyeing unions, or any other textiles, he cannot get results. Yet we have seen bad work come out of a dyehouse in which soft water was generously supplied for dyeing unions. The trouble in this case was that the dyer tried to be too economical. He reused spent baths too often, some of which contained so little color that he might as well have used soiled water. Some of the black spent baths can be reused occasionally with a saving of dye materials, but as a rule it is just about as economical not to use these. Sometimes a very light shade can be obtained from a spent bath which was first used for a dark shade of the same color. But these hit-or-miss shades seldom are profitable to the company.

MEASURING COLORS

The production of synthetic dyestuffs in ever increasing variety and quantity has not been attended by a corresponding reduction of their use to the scientific methods of control and standardization which characterize the manufacturing technique of the present day. The production of synthetic dyes is the result of persistent and continuing chemical research, and the fact that the use of these products remains a craft rather than an accurate science is a tribute to the skill of the dyer and colorist in meeting the demands of industry by "cut and try" methods.

Craftsmanship has surrounded this art with mysterious and meaningless names, which fact brings to the fore the demand for a universal color language. As long as the color of an object cannot be more definitely described than as a pinkish-orange, Alice blue, or invisible green, those industries which are concerned with maintenance of color standards and the purchase of goods on a color specification are laboring under a real handicap.

The maintenance of color standards is another phase of the color problem. With recent advances in the science of color measurements, and the increasing precision and usefulness of instruments designed for this purpose, it is now possible to chart any given color, and thereby create a permanent record that can be referred to as a standard from day to day and year to year. In those industries where color values are of the greatest importance, growing recognition of the utility of such records is anticipated.

The dye industry already recognizes the importance of color graphs and is supplying this useful data to its customers, who, however, with few exceptions, are unable to make practical use of the information. This situation might be likened to furnishing specifications in metric units to a man who understands only British units and is without a conversion table.

Color measurements are also being practically applied to secure the proper balancing of colors for harmonious effects. Within the past few years certain leading manufacturers have successfully applied this comparatively new science to the printing of cartons, posters, and other forms of advertising matter. These practical applications point the way to new developments.

Standardization, control, and harmonious use of colors, which are the practical objectives of color measurements, are of outstanding importance in the dyeing and printing of textiles. It would appear as only a matter of time before the textile industry will recognize the possibilities which the science of color measurements now extends, and the habit of thinking of colors in terms of wave lengths will be as commonplace as the present classification of radio broadcasting stations on a similar scale. An automatic color recording instrument will mark the next substantial step toward the general use of color measurements, and very significantly such a development is now promised from a new application of the now familiar photo-electric cell and radio tube.—Industrial Bulletin of Arthur D. Little, Inc.

DRY CLEANING SOLVENT SPECIFICATION

Much confusion has arisen in the dry-cleaning trade and in testing laboratories in regard to the proper methods of testing dry-cleaning solvent. A specification for Stoddard solvent has been prepared by the Bureau of Standards in complete form. Instead of reference to various sources, complete procedures for each test are included.

Solvent complying with Stoddard's specification is a high flash-point petroleum product which has been adopted by the dry-cleaning industry to lessen the loss of life and property by explosion and fire. The flash-point specified is 37.8 deg. Cent. (100 deg. Fahr.), minimum, closed-cup test. The distillation requirements are: Initial boiling point, 148.9 deg. Cent. (300 deg. Fahr.); end point, 210 deg. Cent. (410 deg. Fahr.).

Many of the refineries are offering products complying with this specification under proprietary names.

The Germans claim to have recovered some ground in world markets in dyestuffs, but it is stated that France is now able to supply its domestic market with Azo (sulphur) dyestuffs, and that it produces in sufficient quantities Indophenole, Thiazine, Indigo and others, which until a few years ago were imported to a large extent. The attempts of the Germans to improve their Chinese market led to a fall of 15 per cent in the price of Indigo and Direct Blue, greatly benefiting the Chinese textile industry, according to Consul H. C. Claiborne, Frankfort, on the Main, Germany.

Testing Methods, Standards and Types for Determining the Fastness Properties of Dyeings on Cotton, Wool and Silk

Part I—Dyed Cotton

Published by the Fastness Commission of the Section for Chemistry of the Dyestuffs and Textile Industries of the German Chemical Society.

(*Third Edition*, 1926, *Verlag Chemie G.M.b.H. Berlin W.* 10, *Corneliusstrasse* 3.)

[Editor's Note: For about fifteen years an organized effort has been under way in Germany to establish standard methods of dye testing. As early as 1911 a sub-committee was appointed by the German Chemical Society, and this developed into what is commonly known as the "Deutsche Echtheitskommission" (German Fastness Commission).

In view of the present interest of the American Association of Textile Chemists and Colorists in the establishment of international fastness standards, it was thought advisable to print the third and most recent report of this commission in the Reporter so that the members of the association might have it in convenient form for examination and study. It is divided into three parts—namely, on dyed cotton, on wool and on silk. These parts will be published in successive issues.

The Research Committee of the American Association of Textile Chemists and Colorists will be pleased to receive any comments on the German methods as compared with those published in the association's year book.]

IN this third edition of the report of the Fastness Commission the standards and types for dyed silk are new; further, the grouping has been altered so that the three kinds of fibers—cotton, wool and silk—are dealt with separately and consequently a better perspective of the report is assured.

The standards and types for cotton and wool remain substantially unaltered, but the figures in brackets following the names of type dyes refer in this edition to the sixth edition of G. Schultz's Farbstofftabellen, Berlin, 1923, and the same is the case for silk.

Further, the methods of testing the fastness to perspiration of dyed cotton and wool have been replaced by the method which has been used for silk.

THE COMMITTEE OF THE FASTNESS COMMISSION,
Beil, Feubel, Haller, Hansmann, Hoomberg, Immerheiser, Jost, Krais, Lehne, Loewenthal, Meyer, Walther.

Frankfurt a. M., March, 1926.

[NOTE.—The lowest degree of fastness is denoted by I, and the highest degree by V. Only in the case of fastness to light of dyed cotton and wool the number of standards is extended to VIII.]

A.—DYED COTTON

1.—FASTNESS TO LIGHT

The test samples, together with yarn or pieces dyed with the types, are exposed to light by suspending under glass in a cabinet located in the open, in such a manner that one-half of the dyed material is covered with thick paper or cardboard.*

The lowest degree of fastness is denoted by I, and the highest by VIII.

TYPES

(The figures in parentheses following the names of type dyes refer to the number in G. Schultz's Farbstofftabellen, 6th edition, Berlin, 1923. The types are dyed on yarn or pieces using distilled water, the bath being twenty times the weight of the cotton.)

I. Five per cent Chicago Blue 6B (424), dyed for one hour in a boiling bath containing 20 grams Glauber salt crystals per liter. (The water which evaporates is replenished by addition during the dyeing.) After dyeing for one hour, a further 20 grams Glauber salt crystals per liter are added, boiling is continued for a further ¼ hour; the material is then squeezed out and rinsed in cold water.

II. 0.8 per cent Methylene Blue BG (659). The cotton is mordanted with 3 per cent tannin by entering into a bath 20 times the weight of the cotton at 60 deg. Cent. and leaving in the cooling bath for three hours; it is then squeezed out, fixed with 1.5 per cent antimony salt in a cold bath for ½ hour, and rinsed well. It is then dyed with the addition of 2 per cent acetic acid for ½ hour cold, then raised to 80 deg. Cent. during ½ hour, and afterwards rinsed.

III. One per cent Indoine Blue R powder (126), dyed on material mordanted with 3 per cent tannin and 1.5 per cent antimony salt as described under II.

IV. Twenty per cent Kryogen Violet 3R (BASF), dyed for one hour at the boil with addition of 1.5 times its weight of sodium sulphide crystals, and 3 grams soda ash and 20 grams common salt per liter. (The water which evaporates is replaced during the dyeing.) After dyeing for one hour, a further 20 grams common salt per liter are added, and the cotton is boiled for a further ¼ hour, squeezed out and rinsed in lukewarm water.

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*In the case of yarns and fabrics it must be remembered that some finishing materials exert a protective action on the dyed shade, and materials so finished always possess a somewhat higher fastness to light than unfinished.

V. Two and a half per cent Benzo Fast Red 8 BL (By), dyed as described for Chicago Blue 6B under I.

VI. Ten per cent Hydron Blue G 20 per cent paste (748), dyed with 5 per cent caustic soda 40 deg. Be. and 5 per cent hydrosulphite conc. powder for ¾ hour at 60 deg. Cent., squeezed out and rinsed well in warm water.

VII. Eight per cent Sulphur Black T Extra (720), dyed as described for Kryogen Violet 3R under IV.

VIII. Twenty-five per cent Indanthrene Blue GC paste (843), dyed with 12 c.c. caustic soda 40 deg. Be. per liter of bath and 6.25 per cent hydrosulphite conc. powder for ¾ hour at 50 deg. Cent. squeezed out, rinsed and soured for 10 minutes in a bath slightly acidified with sulphuric acid. It is then rinsed well again and soaped for ½ hour in a boiling bath containing 10 grams Marseilles soap per liter.

2.—Fastness to Washing and Boiling in Presence of White Cotton

The trial is carried out in the following manner:

(a) The sample, plaited with an equal quantity of white, scoured cotton, is treated in a 50:1 bath containing 2 grams Marseilles soap per liter at 40 deg. Cent. for ½ hour. It is then alternately squeezed out between the fingers and dipped again into the bath, this being repeated ten times. Finally, the sample is rinsed in cold water and dried.

(b) The plaited sample is treated in a boiling (100 deg. Cent.) bath containing 5 grams Marseilles soap and 3 grams soda ash per liter of water for ½ hour, then allowed to cool to 40 deg. Cent. during ½ hour, and next alternately squeezed out and dipped ten times in exactly the same manner as described under (a).

STANDARDS	*TYPES*
I. Treated according to (a): The dyed shade is only a little paler; white cotton is stained.	I. Three per cent Benzopurpurine 4B (383), dyed at the boil with addition of 20 grams Glauber salt crystals per liter, for 1 hour. (The loss by evaporation is made up during dyeing by adding water). After dyeing for 1 hour, a further 20 grams Glauber salt crystals per liter are added, and boiling is continued for ¼ hour; then squeeze and rinse well in cold water.
II. Treated according to (a): The dyed shade is unaltered; white cotton is unstained or only stained very slightly.	II. Five per cent Primuline (616), dyed as described under I, then diazotized and developed with β-Naphthol. Finally, soap with 2 grams Marseilles soap per liter at 35 degrees Cent. for about 5 minutes and then rinse well.
III. Treated according to (b): The dyed shade is considerably lighter; white cotton is only stained slightly.	III. Two and one-half per cent Indoine Blue BB (126), dyed on yarn mordanted with 6 per cent tannin and 3 per cent antimony salt. Dyeing is carried out with addition of 5 per cent acetic acid for ½ hour cold, then for ½ hour, slowly raising the temperture to boiling; boiling is continued for ¼ hour, then rinse and dry.
IV. Treated according to (b): The dyed shade is unaltered; white cotton is only stained slightly.	IV. Twelve per cent Immedial Indone R. Conc. (733), dyed for 1 hour at the boil with addition of 1.5 times its weight of sodium sulphide crystals, and 3 grams soda ash and 20 grams common salt per liter (the loss by evaporation is made up during dyeing by adding water). After dyeing for 1 hour, a further 20 grams common salt per liter are added, then boiled for a further ¼ hour, squeezed and rinsed well in warm water OR: Indigo (874) dyed to exactly the same depth in 3 dips in a hydrosulphite vat using 10 grams Indigo 20 per cent paste per liter. After each dip, oxidize for 10 minutes and finally rinse well.
V. Treated according to (b): The dyed shade is unaltered; white cotton is unstained or only stained very slightly.	V. Alizarine Red (Old Turkey Red).

3.—Fastness to Water

The sample is plaited with white scoured cotton, washed zephyr wool and white silk, so that there are two parts of the dyed material to one part of each of the white materials and each of the latter is in direct contact with the dyed material. The plait is left for 1 hour in cold distilled water (about 20 deg. Cent.) using a 40:1 bath, then squeezed and dried at the ordinary temperature.

STANDARDS	*TYPES*
I. With one treatment, the dyed shade is somewhat paler; white material is stained.	I. Two per cent Chrysophenine G (304), dyed as described under 2, I.
III. With one treatment, the dyed shade is unaltered; white material is unstained.	III. Two per cent Chloramine Yellow C (617), dyed as described under 2, I.
V. With three treatments (using fresh water each time) the dyed shade is not altered; white material is unstained.	V. Eight per cent Immedial Carbon B (720), dyed as described under 2, IV.

4.—Fastness to Rubbing

The dyed material is rubbed vigorously ten times backwards and forwards with a strip of white, unfinished cotton fabric, stretched over the forefinger. The distance rubbed amounts to 10 cm. The dyed material is either fast or not fast.

5.—Fastness to Ironing

The dyed material is covered with a double strip of thin, white, unfinished cotton damped with distilled water (100 per cent water), and ironed with an iron so hot that it begins to scorch white woolen felt under the same pressure. It is ironed until the damp strips are completely dry. The alteration of the shade on a still hot portion of the material is determined by comparison with an adjacent, unironed portion of the material, and staining of the white cover strip is noted.

STANDARDS	*TYPES*
1. The dyed shade is altered considerably; white cotton is stained.	I. One and a half per cent Methylene Blue B (659), dyed on cotton mordanted with 6 per cent tannic acid and 3 per cent antimony salt, from a 20:1 bath consisting of distilled water with addition of 2 per cent acetic acid. Dyeing is continued for 1.5 hours in the usual manner for basic dyes (cf. 1, II), then squeeze and rinse well.
III. The dye shade is altered somewhat; white cotton is unstained.	III. One per cent Benzopurpurine 4B (363), dyed as described under 2, I.
V. The dyed shade is unaltered; white cotton is unstained.	V. One per cent Chloramine Yellow C (617), dyed as described under 2, I.

6.—Fastness to Sulphur Stoving

The sample, plaited with washed zephyr wool and white silk, is soaked in a solution of 5 grams Marseilles soap per liter of water, at room temperature, and then wrung out. It is next placed in a vessel filled with sulphur dioxide, by burning an excess of sulphur, left in it for 12 hours, then taken out, rinsed well in cold water, squeezed out and dried.

STANDARDS	*TYPES*
I. The dyed shade is altered; white wool is stained.	I. One per cent Diamond Fuchsine (512), dyed on tannin-antimony mordanted cotton as described for Methylene Blue B under 5, I.
III. The dyed shade is altered very slightly; white wool is unstained.	III. One per cent Columbia Black FF extra (436) dyed as described under 2, I.
V. The dyed shade is unaltered; white wool is unstained.	V. One per cent Diamine Black BH (333), dyed, diazotized and developed with m-toluylenediamine as described for Primuline under 2, II.

7.—Fastness to Perspiration

The test is carried out as follows: The dyed sample is placed between white wool and cotton, and steeped in a solution containing 50 grams common salt and 2 c.c. conc. ammonia solution per liter of distilled water at 45 deg. Cent. for ¼ hour, then squeezed out and dried.

STANDARDS	*TYPES*
I. The dyed shade is paler; white cotton is stained considerably.	1. One per cent Chrysophenine G (304), dyed as described under 2, I.
III. The dyed shade is unaltered; white cotton is stained.	III. One per cent Diamine Black BH (333), dyed direct as described under 2, I.
V. The dyed shade is unaltered; white cotton is unstained.	V. Twenty per cent Indanthrene Blue RS paste (838), dyed as described under 1, VIII.

8.—Fastness to Alkali (Street Mud and Dust)

Reagent: A mixture of 10 grams quicklime and 10 grams 24 per cent ammonia per liter. The dyed sample is spotted with this reagent, squeezed out, dried at the ordinary temperature without rinsing, and then brushed well.

STANDARDS	*TYPES*
I. Complete change of shade.	I. One and a half per cent Malachite Green Conc. (495), dyed on tannin-antimony mordanted cotton as described under 5, I.
III. Considerable change of shade.	III. One per cent Direct Deep Black EW extra (462), dyed as described under 2, I.
V. The shade is unaltered.	V. Eight per cent Diamine Black BH (333), dyed, diazotized and developed with m-toluylenediamine as described under 2, II.

9.—Fastness to an Acid Boil

In the fastness to cross-dyeing of dyed cotton, the nature of the dye used on the cotton, as well as the nature of the dye used for dyeing the wool plays an important part.

The dyed sample, plaited with an equal quantity of washed zephyr wool and with an equal quantity of white, scoured cotton, is boiled for 1 hour in a 40:1 bath con-

taining 10 per cent sodium bisulphate on the weight of material, then rinsed well in cold water, squeezed out and dried.

STANDARDS	*TYPES*
I. The dyed shade is only somewhat paler; white wool is stained.	I. Two per cent Chloramine Yellow C (617), dyed as described under 2, I.
III. The dyed shade is unaltered or is altered only slightly; white wool is only stained slightly.	III. Three per cent Primuline (616), dyed, diazotized and developed with β-naphthol as described under 2, II.
V. The dyed shade is unaltered; white wool and cotton are unstained.	V. Eight per cent Immedial Carbon B (720), dyed as described under 2, IV.

10.—Fastness to Acids

The dyed material is spotted with mineral acid (10 per cent sulphuric acid) and with organic acid (30 per cent acetic acid), and the alteration in shade determined by comparison with a portion spotted with water.

STANDARDS	*TYPES*
I. The dyed shade is altered considerably by mineral acid, but is altered only slightly by organic acid.	I. Three per cent Diamine Scarlet B (319), dyed as described under 2, I.
III. The dyed shade is altered considerably by mineral acid, but is unaltered by organic acid.	III. One-half per cent Chrysophenine G (304), dyed as described under 2, I.
V. The dyed shade is unaltered by mineral acid, and by organic acid.	V. Twenty per cent Indanthrene Blue RS paste (838), dyed as described under 1, VIII.

11.—Fastness to Bowking (Kier Boiling)

The test is carried out according to two methods:

(a) Five grams of the dyed material, plaited with an equal weight of bleached cotton yarn, are boiled for 6 hours in a 10:1 bath, to which 10 per cent caustic soda 40 deg. Be. on the weight of the material is added; the loss of water by evaporation during boiling is continually made up by additions. The plait is then rinsed well, squeezed out and dried.

(b) The treatment is carried out as described under (a), except that 1 per cent Ludigol on the weight of material is added also.

STANDARDS	*TYPES*
I. The dyed shade is considerably paler after both (a) and (b); white cotton is stained somewhat.	I. A normal Paranitraniline Red dyeing, soaped at the boil after development.
III. The dyed shade is appreciably paler after both (a) and (b); white cotton is unstained or stained only very slightly.	III. Indigo (874), dyed to exactly the same depth as 3 per cent Diamine Fast Blue FFB (C), which has been dyed as described under 2, I.
	OR:
Under III is included also: the dyed shade is paler after (a) and white cotton is stained, whereas white cotton is unstained after (b).	Ten per cent Indanthrene Yellow G paste (849) dyed with one-fourth its weight of Hydrosulphite and 3 c.c. caustic soda 40 deg. Be. per liter for ¾ hour at 40 to 50 deg. Cent., then squeezed out, hung for ½ hour, rinsed well and soaped at the boil for ¼ hour with 5 grams Marseilles soap per liter.
V. The dyed shade is completely unaltered after both (a) and (b); white cotton is unstained or stained only very slightly.	V. A normal Turkey Red dyeing (Old Red).

12.—Fastness to Chlorine

The sample, plaited with an equal weight of white, scoured cotton, is wetted out in hot water and steeped for 1 hour at about 15 deg. Cent. in a freshly prepared bath of calcium hypochlorite (bleaching powder) containing 1 gram active chlorine per liter, calcium hypochlorite 5 deg Be. is diluted in the proportion of 1:20 and adjusted after titration, or in a bath of sodium hypochlorite also containing 1 gram active chlorine per liter and not more than 0.3 gram soda ash per liter (freshly prepared and adjusted after titration as described below).

In either case, then rinse, sour, rinse several times, squeeze out and dry.

Preparation of Sodium Hypochlorite

One hundred grams 33 per cent calcium hypochlorite are made into a paste with 400 c.c. of water; 60 grams soda ash are dissolved in 200 c.c. of boiling water, 100 c.c. cold water are added, and this solution is mixed with the paste of calcium hypochlorite by stirring for ½ hour, and is then left to settle. The clear solution is decanted, 2 grams soda ash are added to remove the remainder of the lime, the mixture is allowed to settle again and the clear solution is decanted, or filtered if necessary, and diluted with the requisite amount of distilled water.

STANDARDS	*TYPES*
I. The dyed shade becomes paler with sodium hypochlorite, white cotton is stained. The dyed shade becomes much paler with calcium hypochlorite; white cotton is stained.	I. One per cent Methyleneblue B (659) dyed on tannin-antimony mordanted cotton as described under 5, I.
II. The dyed shade is altered with sodium hypochlorite; white cotton is unstained. The dyed shade is much altered with calcium hypochlorite; white cotton is unstained.	II. Six per cent Indanthrene Olive G Powder (791), dyed from a 20:1 bath of distilled water, with addition of five times its weight of caustic soda 40 deg. Be., and 2.5 times its weight of hydrosulphite, for ½ hour at 60 deg. Cent., squeezed out and rinsed well immediately.

III. The dyed shade becomes only somewhat paler with sodium hypochlorite; white cotton is unstained. The dyed shade becomes much paler with calcium hypochlorite; white cotton is unstained.

IV. The dyed shade is unaltered with sodium hypochlorite; white cotton is unstained. The dyed shade becomes appreciably paler with calcium hypochlorite; white cotton is unstained.

V. The dyed shade is unaltered with sodium or calcium hypochlorite; white cotton is unstained.

III. Indigo dyed exactly the same depth as 3 per cent Diamine Fast Blue FFB (C), which has been dyed as described under 2, I.

IV. Ten per cent Hydron Blue G 20 per cent paste (748), dyed with addition of one-half its weight of caustic soda 40 deg. Be. and one-half its weight of hydrosulphite, and then proceeding as described for Indanthrene Olive under II above.

V. A normal Turkey Red dyeing (Old Red).

13.—Fastness to Mercerizing

The dyed material is sewn together with bleached, unfinished cotton and steeped in cold caustic soda 30 deg. Be. for five minutes, rinsed, soured, rinsed thoroughly and dried.

STANDARDS

I. The dyed shade is altered slightly; white cotton is stained somewhat.

III. The dyed shade is unaltered; white cotton is stained only very slightly.

V. The dyed shade is unaltered; white cotton is unstained.

TYPES

I. Four per cent Primuline (616), dyed, diazotized and developed with β-Naphthol as described under 2, II.

III. One per cent Chloramine Yellow C (617) dyed as described under 2, I.

V. Eight per cent Immedial Carbon B (720), dyed as described under 2, IV.

(The tests and standards for dyed wool will appear in the next issue)

Dyeing Silk with Sulphur Colors

The Early Use of Sulphur Colors on Cotton—Checking the Action of Alkalies on Silk—Time and Temperature Factors

By Frederick Grove-Palmer

THE changes of fashion bring about alterations that are unknown to the buyer of materials in the shops, but which may affect the manufacturer to a very great degree and give rise to a vast amount of research work on the part of those chemists whose aim in life it is to improve the quality of the goods and to cheapen the cost of production.

The range of dyestuffs known as the sulphur colors or the immedial colors possessed many advantages over the other kinds of dyes which rendered them especial favorites among many classes of dyers. Chief among their good qualities were their fastness to light and to washing; and, incidentally, their cost was also considerably lower, a fact that perhaps outweighed the other advantages. Most noteworthy among this type of dyes was the Sulphur Black, very largely used on stockings in the days when practically every lady in the land wore cashmere and cotton hosiery. She did not always know that she was wearing cotton, but such was the fact in a great number of cases; for manufacturers in the earlier days were perhaps not always above suspicion. Sulphur Black was found to be an ideal dye for cotton, as it did not tend to turn green as so many blacks do after the stockings have been in use for some time.

With the change in taste that was brought about by the cheapening methods of production and the increase of spending power, silk gradually ousted the other fibers from their prominent position and is now almost universally worn by women. This advent of silk in popular taste quickly sent the sulphur colors out of use, because it was immediately discovered that the strongly alkaline baths had a very detrimental effect upon silk.

Checking the Action of Alkalies

There is, of course, no difficulty in understanding this, because of all fibers silk is perhaps the one most readily attacked by alkalies, even when they are employed in the most dilute solutions. The degumming or boiling-off of raw silk depends entirely upon the action of very weak alkali, which dissolves away the silk gum or sericin. During the process of degumming the utmost care is taken to prevent any increase in the concentration of the alkali in the bath or the prolongation of the time of working, in order to avoid any action upon the remainder of the silk substance, fibroin. The result of any such attack would be that the silk would become harsh to handle, the fiber would be brittle and the natural gloss, which is the essential quality of silk, would be reduced.

It was at this stage that the work of the chemist in connection with silk dyeing may be said to have begun. Sulphur dyes were too good a proposition to be given up without struggle, and a vast amount of research was instituted to find some means whereby the strong alkali could be checked in its action on silk fibers. Success crowned the scientists' efforts, and it has now been shown that if the sodium sulphide, which is necessary in the dye bath, is reduced to a certain extent and replaced by an excess of sodium bi-lactate, the deleterious action of the sulphur colors is eliminated. This chemical, it has been discovered, has the property of counteracting the effect of the strongly alka-

line sulphide upon the fibroin and at the same time is not sufficiently active to prevent the necessary chemical reactions taking place which deposit upon the fiber color of almost perfect fastness to light, washing and perspiration.

Sodium bi-lactate is not always obtainable, as it has not a very big market as yet, but it can be made very easily as it is required. The following formula is one which has been found to give perfectly good results:

Dissolve 150 grams of soda ash in 1 liter of cold softened water and thoroughly stir to insure complete solution; then to this add slowly 1 liter of commercial lactic acid of about 50 per cent concentration, stirring all the time. It is very necessary to do this slowly and gradually in order that the reaction between the acid and soda may not be carried too far. The liquid thus obtained is used in making up the dye liquor, which may be done in accordance with the outline formula given below:

The requisite amount of sulphur dyestuff is weighed out and dissolved in water, together with half that quantity of sodium sulphide crystals. When all the solid matter is dissolved, enough of the sodium bi-lactate solution to weigh three times the weight of the sulphide is poured in. This must be carefully strained before it is added to the dyeing tank, in which has been dissolved from 10 to 40 per cent of Glauber salt. This percentage is calculated upon the weight of the batch of goods to be dyed at the one time. The amount of Glauber salt will vary in accordance with the depth of the shade to which the material is to be dyed.

Time and Temperature

Dyeing takes place with the bath heated to a temperature of from 120 to 140 deg. Fahr. for medium shades and at 170 deg. for black; very pale shades need an even lower temperature than 120 deg.

It must be the aim of the dyer to work always at the lowest possible temperature, when using sulphur colors, that will enable him to produce the depth of tint specified. This is not for the reason that lower temperatures mean less steam used and consequently lower production costs, though that is a vitally important reason; but the cooler the liquid in which the silk is worked the less likelihood is there of any deterioration taking place.

The time required for dyeing is about one hour; it should not be any longer than this, for though the dangerous alkali is buffered by the addition of the sodium bi-lactate, it must not be forgotten that it is present, and where there is alkali in contact with silk there is risk of good money being lost. This fact cannot be insisted upon too strongly, as it is one which many dyers are liable to overlook.

When the desired shade has been obtained, the goods are lifted from the dye bath and drained, being then taken to the hydro-extractor. The rinsing must be very thorough; more washing is needed than with other classes of dyestuffs. The final treatment is usually a running through a scrooping bath in order to give the silk the necessary "handle."

TESTING LABORATORY SET UP BY MACY'S

To provide for testing the merchandise offered by it for sale, and to insure accurate representation of its quality and content, R. H. Macy & Co., of New York, have just established a Merchandise Testing Laboratory on the fifteenth floor of the store.

It is planned to develop the work of this laboratory under expert technical direction so that it will operate as a Bureau of Standards for the store, comparable to the Federal Bureau which tests and guards the quality of all commodities purchased for the use of the United States Government. Experts have estimated that the Federal Bureau of Standards saves the Government $100,000,000 annually. Economies in the large scale purchasing of Macy's are similarly expected, for it will be the aim of this laboratory to promote more scientific buying by selection from the competitive offerings of thousands of manufacturers, the merchandise representing best value per dollar cost.

In furtherance of the plan, an advisory committee will be established, comprising an authority from each of the following fields: Chemistry, microscopy, dyestuffs and textiles, foods and drugs, metallurgy and cosmetics. It will be the function of this advisory committee, the personnel of which has not yet been finally determined, to work with Macy's technical staff in the definition of proper standards for various kinds of merchandise.

The store's decision to institute the service follows experience with merchandise testing conducted on a small scale during the past year. It was found in some cases that vagueness existed in the mind of the manufacturer as to the material content of his merchandise and the exact proportions thereof.

Included in the apparatus installed in the Macy laboratory are a number of the most modern devices for testing various properties of merchandise. A Fadometer, for instance, will enable simultaneous tests to be made of the color fastness of forty different fabrics. A motor-driven tensile strength tester will determine the strength of fabrics. The machine operates by tearing the material to be tested, a pendulum registering on a scale the exact force necessary to do this.

One of the most interesting devices is a new photomicrograph which can enlarge a human hair up to an inch in width, and flash the enlarged picture on a screen. Supplementing this machine is a micro-analyzer for studying different types of weave. It enlarges the thread and weave so strongly that the slightest irregularity is visible.

In order to acquaint the store's staff of seventy-seven buyers with the workings of the new laboratory, a series of lectures by the graduate chemist in charge are planned.

Coated Textiles*

The Nature and Use of Artificial Leather—Manufacture of Rubber-Coated Materials and Their Application to Auto Equipment—An Important Contribution of Chemistry

By HAMILTON BRADSHAW

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THIS paper is intended to give very briefly an idea of the extent to which the coated textile industry is a chemical industry and its problems chemical problems. During nearly fifteen years' contact with the manufacture of coated textiles, the writer has had a growing appreciation of the manifold ways in which chemistry serves this industry and the possibilities of further development along purely chemical lines. Fifteen years ago our chemical work consisted largely of control analyses of raw materials and our experimental work was chiefly an attempt to make new combinations of the usual ingredients. During the last five or ten years the growth of the science of colloid chemistry and the development of methods of utilizing this science in industrial research have made possible a much more scientific attack on the problems of this industry. It is of considerable interest that the company by which the writer is employed has recently shown its appreciation of the importance of increasing our knowledge of the colloid chemistry of such materials as nitrocellulose and rubber by embarking on a program of fundamental research in colloid chemistry, particularly of nitrocellulose dispersions. It is hoped that the efforts of three or four carefully selected men of recognized ability in this field will result in many important contributions to existing scientific knowledge.

There are three principal types of coated textiles, differing in the nature of the coating applied to the fabric. The three basic materials used are pyroxylin, and rubber types, and consequently will have more to say about these than about the linseed-oil product.

Linseed-Oil Materials

This group includes the large industry of oilcloth manufacture, which has little application in an automobile, but several varieties of top materials have also been made with linseed-oil coatings and they have been of considerable importance in this field.

Artificial Leather

The term "artificial leather" is usually applied to the pyroxylin-coated product, although this designation is frequently very misleading. When the product is embossed in leather grains it very closely resembles real leather, but for many purposes there is no intention of imitating leather and conventional designs of great variety are used. The largest consumption of artificial leather in the automobile industry is for upholstery. About 90 per cent of the open cars made in 1926 were upholstered with this material, and the writer has been told that there is a growing demand for artificial leather for several makes of cars which have not been using it for several years. The reason for this is the difficulty of getting an adequate and uniform supply of real leather. In a great many cars in which real leather is used for the seats, the pyroxylin-coated product is used elsewhere—for example, the door panels and kick boards. Rather recently it has become popular for the instrument board and for the curtains of closed cars. A large amount of it is used for the side walls and head linings of taxicabs. In many cases it is not used as a substitute for real leather, but as a distinctive material with its own peculiar advantages.

In a number of cars marketed in recent years it has been the practice to make the artificial leather exactly match the real leather in color and pattern. As an illustration of the fine appearance and quality of artificial leather, a recent experience with a popular sport roadster might be mentioned. Having been interested in artificial leather for many years, the writer feels pretty well acquainted with most of the little tricks of distinguishing it from real leather. In this case, however, it was absolutely impossible to tell in what parts of the car the real leather and the artificial leather had been used, until a corner was turned up here and there, and the back of the goods examined. The principal seat was found to be upholstered in real leather, whereas artificial leather had been used on the rumble seat and the panels. The appearance and feel seemed absolutely identical.

The significance of the manufacture of artificial leather as a chemical industry is shown by the simple chart which has been prepared to show the number of chemical industries which contribute to this product. The solvents come from molasses and from lime and coal, the latter forming the raw materials of the wonderful synthetic acetic acid industry. The purification of crude linters for making pyroxylin requires caustic soda and chlorine, another enormous chemical industry. The nitric acid used for nitration of linters will soon be made by oxidation of ammonia, and this, in turn, will be made in synthetic ammonia plants. Pigments of great variety are used, many of them products of complicated chemical processes. Bone, Black, Carbon Black, Chrome Yellow, Prussian Blue, Ultramarine Blue, Chrome Green, and

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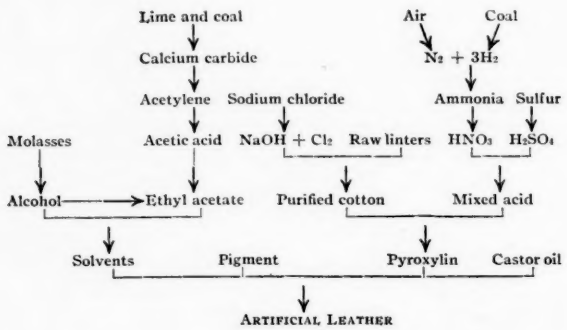
Scarlet Lake are good examples. The softener is almost exclusively castor oil, either raw or treated. In some specialties, however, it is advantageous to use other softeners, carefully selected because of the properties they impart.

A very important development of recent years in the artificial leather and related industries is the recovery of solvents by improved methods, especially by activated carbon. The manufacture of this type of carbon and its use for solvent recovery have been developed largely in the past ten years. It has made possible a greater economy in operation, a vastly improved plant ventilation, and freedom from solvent vapor explosions, which previously threatened life and property.



The most serious chemical problems in connection with the quality of artificial leather have been exudation, accompanied by stickiness, brittleness on aging, and unpleasant odor. These problems have all been solved by persistent research on all the ingredients of the film—namely, the pyroxylin, the oil, and the pigments, and, indeed, the solvent also. The modern artificial leather is a very satisfactory product, of excellent appearance and long life.

Rubber-Coated Material

The only large application of rubber-coated material in the construction of an automobile is for the top. Rubber-coated top materials have been used in open cars for many years; in fact, the automotive industry inherited this product from the carriage industry. "Carriage cloth" was the commonly used name of the product ten years ago. Other products have had their vogue for open cars and have disappeared, and rubber is now almost universally used. Rubber top material consists of a layer of rubber compound laid on cloth and finished with varnish. The appearance and durability depend on all three parts of the product—the fabric, the rubber compound, and the varnish—but chiefly on the last. The fabric backing may be either a single layer, or two layers joined with rubber cement. The commonly used ingredients of the rubber coating compound are new rubber, reclaimed rubber, mineral rubber, coal tar, whiting, carbon black, and vulcanizing agents.

Whereas a few years ago it was customary to vulcanize top material three to six hours, this period has been cut in half, partly as a result of better compounding and partly by the use of organic accelerators. For some purposes, indeed, vulcanization is accomplished at room temperature, so that a separate vulcanizing procedure is avoided. A number of organic substances are now being used in rubber compounds to improve the aging of the product. Antitoxidants are receiving considerable attention likewise in the rubber-coated textile industry and improvement in quality is to be expected as a result of their use.

Another compounding ingredient which is used in relatively small proportion but has a very important effect is Carbon Black. The importance of its use in top materials to protect the rubber against sunlight and to toughen the compound has been appreciated in the last few years, just as it has in the manufacture of tires.

The most important contribution of chemistry, of which the writer has any knowledge in this field in recent years, is the development of a closed-car deck material of the rubber-coated type that possesses unusual durability and retention of luster. The history of this development may be of interest. In the early days of closed cars the tops were of wood or metal, but these solid tops were noisy and expensive. The cars were soon redesigned to take a fabric top and pyroxylin-coated products were generally adopted. The gradual evolution of the coach type of closed car, and the necessity of competing in price with the open car, brought a demand for a satisfactory material of lower cost, and the rubber-coated product was given its opportunity. Meanwhile, work on an improved product for closed cars had been started about six months before rubber-coated textiles began to be used for this purpose. After nearly eighteen months of intensive research and six months more of thorough testing, the product known as Everbright was ready for the market. It is a combination of a special rubber composition with an unusual varnish. On exposure to the sun it develops only extremely fine checks, practically invisible to the unaided eye. It does not crack or chalk, and it retains a satisfactory gloss almost indefinitely. Incidentally, the rubber compound also is durable and shows no tendency to become hard or brittle. Anyone who is familiar with the quality of most rubber-coated deck materials knows that these properties are evidence of a real contribution of chemistry to automotive transportation.

Mention of the colored top for sport cars and for closed cars has been left until last. Colored material for closed cars is almost exclusively of the pyroxylin type; a satisfactory colored rubber product has not yet been marketed. For open cars a variety of materials has been used. At first the vogue was for a Burbank cloth made water-repellent by a chemical treatment. The industry later turned to ducks and drills dyed with sulphur colors and combined with rubber cement. The layer of rubber cement guaranteed this material against leaking, but it faded quickly and became very dirty. A typical example

was the khaki-colored top used on a maroon car of a popular make about four to six years ago. To-day the best products are similar to that just described except that they are dyed with vat dyes which are much more nearly sun-fast.

Conclusion

Coated textiles have made an invaluable contribution to the economic development of the present-day automobile. The layman's conception of coated textiles is usually that of a product made as a substitute for leather. The fact is that the larger portion of the coated textiles used in an automobile is not made to resemble leather. Those that have this appearance do not compete with real leather but with each other, on the basis of the special properties of the various types. Even for upholstery, the development of the automobile has so far outstripped the supply of natural leather that it could not be increased to meet the demand of the automotive industry except by prohibitively expensive methods. The great mass of cars now in use would be less comfortable, less durable, and less attractive had there been no development of coated textiles to supplement the limited supply of natural leather and to meet those requirements for which leather is not especially suited.

Prevention of Accidents in Chemical Laboratories*

Danger Lurks in Untidiness—Storing of Apparatus and Chemicals—Specially Dangerous Materials Call for Care—Reagent Experiments Hazardous—Flammable Materials—Ventilation Hints

By DR. J. W. STILLMAN

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In discussing this subject, for the sake of completeness, it will be necessary to review many precautions which are well known and probably generally practiced. In one sense this repetition is of real value in familiarizing those who are responsible for the manufacture, handling and use of chemicals with the rules of safe procedure. It is proposed in this paper to make a rather complete survey of the operations which are common to chemical laboratories, giving suggestions as to steps which may be taken to avoid accidents and in a few cases illustrating the point by describing accidents which have happened when safety has been overlooked or ignored.

Of course, the first topic to be considered should be the design of the building to be used for laboratory purposes, but this varies so much, depending upon the purpose for which it is to be used, that it is difficult to outline a standard plan. One or two essential points can be mentioned, however. It is unwise to have laboratory rooms open out of another room which is used for laboratory purposes, because in case of fire in the outer room, escape from the other rooms might be cut off. The same thing applies to the arrangement of tables within the rooms. Aisles between tables should be open at both ends in case a sudden fire should make escape in one direction impossible. All exit doors should open outward and fire extinguishers should be placed at accessible points, particularly good locations being beside doors or windows where they can be reached from the outside. Adequate ventilation is very necessary in the chemical laboratories where the fumes which are the product of many reactions are in most cases at least irritating. Hoods equipped with an exhaust fan should be a part of the permanent building equipment. Very attractive hood designs are obtainable made up with alberene stone. A new method which has proved to be very satisfactory is to have the exhaust flue built in behind the rear wall of the hood with intake openings in the form of slits about three-quarters of an inch wide and graduated in length so as to give a uniform draft. A row of these slits is placed in the back wall both at the level of the table top and at the top of the hood.

In cases where there is considerable amount of a poisonous gas being used and where there is danger of the gas escaping through leakage or in the changing of apparatus, as for example when carbon monoxide is being used as a raw material for calytic reactions, a special ventilating system designed to exhaust the entire air of the room in a given time should be installed. This gas is usually prepared at or near the point where it is to be used and is a treacherous poison because it has no color or odor to act as a warning. The danger is well understood on account of the newspaper publicity which has followed the numerous accidents, which in many cases have been fatal, from the carbon monoxide expelled in the exhaust gases of automobiles. A wise precautionary measure is to have a gas mask, equipped for protection against the gas likely to escape, placed outside the laboratory and plainly marked so that if it is necessary to enter the room when it is filled with a poisonous gas, the equipment to do it safely will be at hand. Also, in case an accident should occur, those who are working with this gas should be provided with inhalation apparatus designed

*A paper delivered before the Chemical Section of the National Safety Council at the Annual National Safety Congress held in Chicago, September 26 to 30.

for the treatment of carbon monoxide poisoning and should be instructed in first aid methods.

Untidiness and Its Consequences

Untidiness, which usually is the result of carelessness, is repulsive to almost everyone, but that it can be a contributory cause of accidents is many times overlooked. Neatness, which will of course promote greater efficiency in the worker, should be classified as one of the primary requisites of safety in the chemical laboratory. When chemicals are spilled, the remains immediately should be cleaned up. If stray particles of various kinds are allowed to accumulate over a period of time, mixtures may result which will of themselves start a fire, which, being communicated to scraps of paper or other waste, will spread rapidly. Special care should be exercised when using sodium, sodium peroxide, phosphorus, etc., to see that all strays be collected and disposed of. It has recently been advised that if metallic mercury is spilled in handling, every effort should be made to have all of it cleaned up on account of its poisonous qualities. Mercury is used extensively in the laboratory as a confining and indicating liquid in gas pressure gauges and in gas analysis apparatus, and while it has been known that it is poisonous if taken internally, the idea that liquid mercury exposed in the open room would give a concentration of vapor which would be dangerous to the health when the air is breathed has caused some discussion. Frequently, in cleaning and handling the mercury, some is spilled on the table or floor and in the past no particular effort has been made to clean up the spilled mercury thoroughly since it was considered entirely harmless Now evidence[1] is brought forward which tends to show that sufficient mercury is volatilized from the scattered drops in the room to give a concentration of mercury in the air which will cause mercury poisoning. The poisoning develops slowly on account of the low concentration of mercury, but the lungs seem to retain it from the air breathed. If the evidence is correct, precautions should be taken to reduce the amount of mercury spilled to a minimum and to avoid keeping it in open vessels. In general it can be said that the floors and tables of the laboratory should not have cracks or depressions which will permit the trapping of waste chemicals of whatever nature they may be.

The work table should be kept free from apparatus or chemicals which are not actually in use. When apparatus is set up it should be placed well back from the front edge of the desk. This will provide larger working space and also avoid accidental upsetting of the apparatus. Also when vessels containing hot or corrosive solutions are placed on the table, even temporarily, they should be set far enough back so that they will not be brushed off by a person passing by.

All bottles should be marked with a label which is easily legible in order to avoid the use of the wrong reagent as well as to prevent the contamination of the reagents when refilling the bottles. If a rule is adopted that the janitor is permitted to discard the contents of any bottle having no label, the habit of carefully marking the bottles will soon be learned by the chemists. Only small stocks of chemicals or flammable liquids should be kept in the laboratory. Unless a chemical is being used continually, a pound or half-pound should be a sufficient amount to keep on hand and a gallon of alcohol, benzene, ethyl acetate, etc., should meet all requirements for these solvents. The stock of reagents should be classified and arranged in a neat, orderly manner in a cool, dry part of the laboratory. The flammable solvents should be segregated and should be so located that in case of fire exit from the room will not be cut off.

Storing Apparatus Safely

Glassware for immediate use should be stored in a way to avoid breakage. Severe cuts are the result of reaching into a closet and coming into contact with the ragged edge of a piece of broken apparatus. Beakers, flasks and bottles can be taken care of by providing a large closet at the side of the room which is equipped with shelves and doors to keep out dust. Condensers and complete units of glass apparatus such as Soxhlet extraction apparatus should be kept in drawers, preferably with cotton on the bottom. No more apparatus should be placed in the drawer than can conveniently be arranged on the bottom. In other words, one piece should not be piled on top of the other, for then there is danger of breakage in opening and closing the drawer. Pipettes and burettes can be protected by equipping the drawer with strips of wood running lengthwise of the drawer in which are cut grooves just large enough to admit the piece of apparatus in question.

Large stocks of standard apparatus and chemicals for the use of the whole laboratory organization and selected according to the nature of the work being done should be kept in a central storeroom in charge of a competent stores-keeper. Excess stocks of either apparatus or chemicals when no longer needed should be returned to the central storeroom. If this is not practicable because of accounting difficulties, a group of chemists doing similar work should be provided with a storeroom or storehouse and the excess stock can be classified and kept here. Some one person should be responsible for this storehouse. An up-to-date record of the stock should be kept and care should be taken that explosive or flammable compounds are not allowed to accumulate to a dangerous amount.

To return to the central storeroom, there are one or two rules to be observed here. All volatile flammable liquids should be suitably protected and kept in a proper building located at a reasonable distance from other buildings. This building should be kept as cool as possible and should be well ventilated. A drain should be pro-

(1) Dennis, Ind. & Eng. Chem. 18 (1926), 1205.

vided to carry off any spillage. Suitable fire extinguishers should be provided and are best located on the outside of the building.

It is customary practice to store chemicals by arranging them alphabetically according to their metallic constituents; for example, all nickel salts are classified under N and all sodium salts under S. It is debatable whether or not this is the best method. Included in the list of chemicals which are ordinarily used will be many oxidizing agents belonging to such classes as nitrates, chlorates, permanganates, peroxides, etc. The most of the compounds of this sort would not start a fire of themselves but on account of their ability to give up oxygen when heated, as a class they will promote and intensify a fire once it has been started. This is recognized by the postal authorities, and only a very small quantity of an oxidizing agent is permitted to be shipped by mail. The suggestion, therefore, is made that it perhaps would be better to take at least the extra supply of oxidizing agents out of their alphabetical classifications and place them together in a fireproof building, room or compartment.

Glassware should be kept on shelves with raised strips across the front to prevent any pieces from being knocked or jarred off. No pieces should be allowed to extend over the edges.

Hints on Handling Specially Dangerous Chemicals

Metallic sodium and potassium, on account of the fact that they react readily with the moisture of the air and ignite spontaneously, have to be kept under kerosene. The safest plan is to transfer the sodium or potassium, when received, to glass jars equipped with tightly fitting glass stoppers. Each jar should then be set in an enamel bucket for protection in case the glass jar breaks. If kept in tin cans, the kerosene may leak out unnoticed. A separate fireproof building should be provided for the storage of large quantities of sodium and potassium, and frequent inspections should be made to see that sufficient kerosene is in all the bottles.

Yellow phosphorus also requires special care in storage on account of its fire risk. Yellow phosphorus must always be kept under water in a similar manner to the sodium under kerosene, but phosphorus and sodium must be kept in separate buildings because of the danger of adding water to a sodium container by mistake. Care should be taken in winter to avoid breakage of the bottles through freezing of the water. A double container, as suggested above, is a wise precaution.

An accident which illustrates what may happen through the careless handling of chemicals can be described appropriately at this point. This accident occurred in the student laboratory at a large university and aroused a great deal of interest on account of the legal aspects of the case.[2] A young woman student was carrying out an experiment which called for the heating of a mixture of mercuric sulphide and lime in a glass tube closed at one end. The mercuric sulphide was issued to the students by an attendant in the storeroom. The lime was placed in bottles on the side tables and was obtained by each student for himself. Some students were working on previous experiments which called for the use of potassium chlorate, which was also on the side table in bottles. It is supposed that the young woman selected the wrong bottle, because an explosion followed the heating and, as a result, the young woman lost one eye. The contents of all bottles on the side tables were examined after the accident and found to contain nothing but the reagent called for by the label. The unused portion of the mixture heated by the student was found to contain mercuric sulphide and potassium chlorate but no lime.

The student brought suit against the university on the basis that there had been negligence on the part of the instructors in not analyzing the contents of every bottle on the side table to see that they agreed with the label. The lower court awarded damages of $25,000 to the plaintiff, but this was later reversed by the higher court when the decision was appealed.

The first lesson to be gained from this description is that too much emphasis cannot be placed on the proper labeling of containers, which has already been referred to. Next, it teaches that the operator, whether student, instructor or industrial chemist, should exercise care in selecting the proper container by noting the label before using the contents. It is obviously impossible to analyze the contents every time a bottle is refilled, but in refilling bottles special care should be taken to see that the material is the same as called for by the label.

"Stunt" Experiments with Reagents

As a result of this accident, many colleges have sought by various means to reduce the possibilities for such an accident. The danger lies not entirely in the selection of the wrong reagent from several placed at the disposal of the students, but also in the fact that there are students who, anxious to "see what will happen," will try mixing together various chemicals which they find accessible. One authority has gone so far as to recommend that colleges should exclude from their courses for beginners an experiment which calls for the use of a reagent which might be dangerous if mixed with any other reagent used throughout the course. This is quite evidently an impractical suggestion, but one institution has a plan under which a list of chemicals which cause danger reactions is withheld from the students except on permission of the head of the department and a signed statement by the student that he is familiar with the chemicals and their characteristics and will not hold the college responsible for accident.

This accident points the way to a service which colleges and universities can perform which will not only protect themselves from the results of accidents but will

(2) J. Ind. & Eng. Chem. 13 (1921), 1079.

prove to be of great benefit to the chemical industry. In the training of chemists, there has been a general lack of instruction based on the question of safety, and this ought to be remedied. The so-called physical and chemical properties of the various common reagents which are to be the chemist's future tools are thoroughly studied but very rarely is mention made of the physiological properties of the same compounds. Certain compounds such as potassium cyanide which are especially dangerous poisons are warned against, and in the same way a few of the more flammable and explosive compounds are mentioned specifically. What is required is a general classification of chemical compounds with emphasis laid on their safe handling. It would be a hopeless task to pick out every combination of chemicals which would be dangerous, for in his daily work the chemist is called upon to handle many unusual compounds, but these can easily be classified, however, according to general rules.

Fire Hazards

For example, it is well known that oxidizing materials on the one hand react readily with reducing materials on the other hand. Now, from the point of view of safety, it might be added that this reaction is usually accompanied with the evolution of heat, which may lead to spontaneous combustion, and in many cases if external heat is applied the reaction may proceed with the violence of an explosion. To return to the accident described above, sulphides in general are reducing agents and mercuric sulphide, therefore, belongs in this classification. Potassium chlorate is one of the outstanding examples of an oxidizing agent met with in the study of chemistry. So the accident which probably was caused by heating a mixture composed of a typical reducing agent and a typical oxidizing agent gives a very good example of the generalization laid down above. Neither one of the two components can be classified as a dangerous substance according to the usual standards, so that a study of safety based on the listing of dangerous substances would be futile.

It seems to the writer that the college or university is the proper place for this safety instruction to be given, for it is from these institutions that the chemical industry draws its workers, and the new employee is not fitted to take his place in the industry where he may endanger other lives as well as his own, if he does not understand the materials he is about to handle. The chemical industry as well as industry in general has made rapid strides in the adoption of safe procedures in the last few years, but their task would be much simplified if the principles of safety could be learned at school at the same time and along with other chemical principles.

An accident which occurred several years ago in the laboratory of the large manufacturer of toilet articles, and which resulted in the death of two men, is an example of the dangers involved in the handling of flammable materials.[3] The chemist and his assistant were carrying out a reaction which involved the use of ether. Both men were familiar with the ordinary course of the reaction, but in this case the belt came off the stirrer which resulted in local overheating inside the reaction vessel and ether fumes escaped into the room. The chemist had one of his assistants open the windows for better ventilation, and he stepped over and threw a switch controlling the stirring apparatus. This caused a spark which ignited the ether vapor in the room, and the resulting puff blew the man standing at the window through the opening. He was not seriously injured. The fire which followed caused burns to the chemist and the assistant working directly with him which resulted in their death the next day. The laboratory was practically a total loss.

Almost everyone realizes the extreme flammability of ether, but a point which is not often realized is that the vapors which travel along a surface, as for example, the laboratory table top, and a spark or flame at some distance from the source of the ether will ignite the mass of vapor. In using ether or similar volatile flammable liquids, no open flame should be allowed on the same table. If the ether is to be boiled or distilled, the heat from an ordinary incandescent bulb is sufficient for the purpose. Of course, electric switches or devices which may cause a spark should not be operated when ether or other volatile flammable liquids are being used nearby.

Compressed gases in cylinders here come to be included in the list of essential supplies for a laboratory. Among those most often used are oxygen, hydrogen, carbon dioxide, nitrogen, ammonia and chlorine. If welding is done, acetylene should also be included in the list, and recently a number of the less common gases have been made available in cylinders. One precaution which is applicable to all gases is that the cylinders should be kept in a cool place. If exposed to heat the pressure will be increased and the cylinders become a menace to safety. Whenever possible, tanks of compressed gas should be placed on the outside of the building and sheltered from the direct sun. Piping can then be run from the tank to the laboratory table with a needle valve control just inside the building wall. A corrosive gas such as chlorine cannot be conveniently handled in this way.

Ventilation to Prevent Gas Dangers

In using oxygen it should be remembered that oil should be avoided in all valves and lines. Also hydrogen and oxygen should not be used interchangeably with reducing valves or pipe lines. Not only do the two gases form explosive mixtures, but the hydrogen may contain traces of oil which is used in connection with the compression of this gas. To avoid the interchanging of connections, oxygen tanks are equipped with right-hand and hydrogen with left-hand threads.

Another gas which is coming into use in cylinders is

(3) J. Ind. Eng. Chem. 11 (1919), 490.

hydrogen sulphide. This can be called one of the primary reagents of the chemical laboratory. Formerly it was prepared by the action of hydrochloric acid on iron sulphide in a Kipp generator, which, however, was not very satisfactory because the capacity of the generator was comparatively small, and in cleaning and renewing it more or less of the gas escaped into the room. Hydrogen sulphide has the unpleasant odor of rotten eggs, and, contrary to the general opinion, it is quite poisonous. During the war a chemist was given the assignment of selling the waste niter cake from nitric acid manufacture, and in doing this he frequently made demonstrations of the possibilities of its use. While working in a small, poorly ventilated room which was used as the laboratory for a company whom he was trying to interest in niter cake, the chemist was overcome by the hydrogen sulphide gas and later died from its effects.

Hydrogen sulphide causes irritation of the eyes and respiratory tract and as little as 0.10 to 0.15 per cent in the air will cause death in one-half to two minutes.

Laboratories should be and generally are now equipped with a hood which is ventilated by a strong draft from a suction fan. With such equipment hydrogen sulphide, chlorine and other poisonous and corrosive gases can be handled in perfect safety. The hood should be used for all reactions in which irritating fumes or smokes are given off.

Chlorine is another corrosive gas, but chemists are quite familiar with its characteristics. The greatest danger from chlorine lies in the sticking of the valve at the top of the cylinder. Due to the presence of moisture, the chlorine may corrode the valve stem and then, when pressure is applied, the valve or its threads may be twisted off. If a valve does stick in this way, the tank should be moved out-of-doors to a place away from where people are working, before an attempt is made to open it.

Chemists should realize that they are dealing with materials which, when isolated, are not in themselves dangerous in many cases, nevertheless are hazardous to life and property when grouped together as they are in general chemical research work. It should be the duty of each chemist, if it has not been a part of his school training, to learn the characteristics of his materials, with the idea of handling them safely in consideration of his fellow worker as well as of himself. Minor accidents should not be expected; they should be prevented.

Practical Hints on the Production of Bright Colors on Textile Fabrics

Part XXXIII

Bright Colors with Basic Dyes—The Oil Mordanting Process—The Equipment Required—A Drying Apparatus; Its Construction and Operation

By RAFFAELE SANSONE

BASIC dyestuffs offer great advantage for producing a wide range of shades on cotton fabrics, the brightness of which cannot be surpassed by other colors. Besides this, with a convenient selection, the fastness can be regulated in accordance with requirements. Thus, with some of the brightest effects a moderate resistance to washing is overlooked, while with other articles the clients insist on a fair fastness not only to washing but also to light. The cost of the dyeing can also be regulated in accordance with the requirements of the market by avoiding or using a mordanting process or by substituting this through the adoption of a more simple preliminary treatment of the material. The treatment can be conducted on the jigger, continuous dyeing machine or padding machine.

The basic colors can be applied on cotton cloth goods through different processes, the principles of which are based on:

1. Dyeing cotton fabrics which have been mordanted with a soluble oil.

2. Dyeing fabrics which have been treated with aluminum acetate and a suitable oil-fixing agent.

3. Dyeing cotton fabrics which have been treated with a suitable prepared oil, an aluminum acetate solution and a fixing bath.

4. Mordanting overnight in a weak tannic acid bath, fixing the next morning with tartar emetic and dyeing or padding with the basic dyestuffs.

5. Mordanting rapidly with a strong tannic acid bath, fixing with tartar emetic and dyeing or padding with basic colors.

6. Mordanting and dyeing in one bath.

7. Dyeing several times with a bath containing only the basic colors after intermediate drying operations.

The Oil Mordanting Process

For producing very bright shades the cotton-cloth dyer sometimes passes his goods once or twice in sulphonated castor oil or sulphonated olive oil, using in this instance a bath prepared with ten parts of the oil for every one hundred parts of water. After the treatment the material is dried at a temperature which is not, however, allowed to exceed 50 deg. Cent. to avoid

the production of irregular shades. With the idea of eliminating the running of the solution, which would cause a stronger quantity of the oil to be fixed in some parts than in others, the material is passed between squeeze cylinders kept under a strong pressure, or hydro-extracted. Both methods of treatment give good results.

The drying of the cloth is performed in some works by hanging the goods for twelve hours in closed rooms out of contact with the direct rays of the sun, while in others the ordinary mechanical apparatus is preferred where the temperature of the hot air circulated through is brought lower and the speed of treatment is reduced to allow a longer drying.

After the drying, the oiled cotton cloth is left with a thin layer of dried oil, being colored more or less in accordance with the quality of the sulphonated oil used. In this case the brightest effects are obtained with sulphated castor oil. With first-quality products produced from olive oil, however, many satisfactory effects are also possible. The cloth mordanted as above is usually colored in a dye bath containing the basic dyestuffs, starting in the cold and bringing gradually to 50 deg. Cent., from which the material is taken out as soon as the desired intensity has been reached, hydro-extracted without washing, and dried. In some cases a slight rinsing is conducted. This is, however, scarcely to be recommended, as the extraction of some of the color can follow.

When all excess of liquid has been eliminated from the cotton cloth, this is dried toward 50 deg. Cent. and finished off as most convenient. With the above process very bright and delicate shades are obtained by using the Rhodamines, Safranines, Auramines and other special basic colors. The fastness is not, however, good in this case, although sufficient for satisfying many purposes. It is often of value for coloring very light cotton fabrics, such as curtain cloths, voiles, light dress goods, etc., the consistence of which is increased through introducing in the oiling bath or in the dye bath a suitable thickening agent, such as dextrin, a weak starch paste, some gum, or island moss mucilage, etc.

The Plant Required

The plant required is composed generally of a machine for treating with the prepared oil, a drying apparatus, dyeing machines, etc. The machine for treating with the prepared oil is constructed as shown in Fig. 1.

This comprises two long squeezing bowls, A and B, held in the strong iron frame-sides S and G, the uppermost of which is often covered over with India rubber, while the lower is copper-plated. Bowl A presses lightly on bowl B, its short end-shafts remaining continually pressed by the upper screws C and M, which turn in upper arms held under the action of light levers and weights, thus assuring a certain elasticity which reduces the wear of the upper bowl covering.

The axle of bowl B is keyed to the large pinion wheel L, turned by a second but much smaller pinion wheel driven by an electric motor or from an upper transmission, as most convenient. The machine is started or stopped by drawing forward or pushing back hand-lever U. Two pieces of cotton cloth to be treated are placed on a lower wooden beam on the

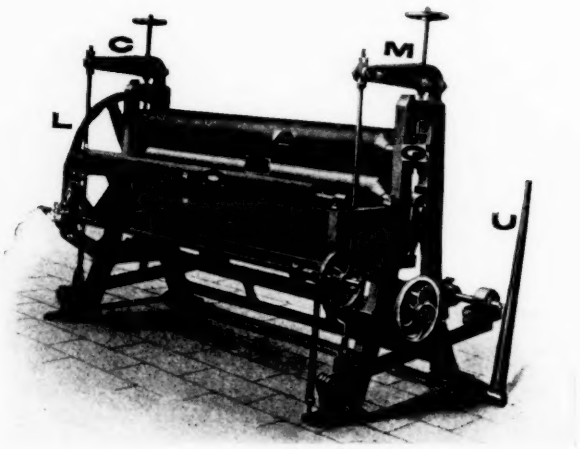

Fig. 1

front of the machine which fits on an iron rod, one end of which enters freely in an open iron guide, while the other is fixed to a special device by which it is kept continually under the action of a light brake to avoid all slipping and a too loose entrance; without, however, causing useless stretching. Before running in the bath of treatment, the cloth passes on the upper roller O, which turns loosely with it.

At the back of the machine are placed bearings, through which a second wooden beam can be introduced at any time or when it is necessary to wind on a batch of material. This is turned by a special arrangement directly connected with the rest of the driving mechanism. Below bowls A and B is placed a narrow wooden trough E or an iron trough lined with glass, raised or lowered by turning a small hand wheel.

A Drying Machine

When mechanical apparatus are employed for drying the oiled cotton cloth, those of large size are generally preferred, as a greater quantity of cotton cloth can be treated at a time. In this instance, however, the apparatus shown in Fig. 2 would offer special advantage.

In this is shown a large, strong iron case O, the exterior of which is furnished with a suitable insulating means, while the interior has a special covering to pre-

vent the formation of rust. Several doors and windows are furnished, and there is a double perforated ceiling enclosing a narrow space in which the hot air is pumped upward from many parts by centrifugal pump P. At the bottom of case O is a double perforated bottom, across which hot air produced in heater H is mixed with a certain quantity of cold air and spurted upward. In this way a constant and uniform passage of the air is assured. Heater H receives from a tap a constant quantity of cold air from the outside, which is heated to the desired degree through a long iron serpentine coil in which circulates hot water prepared in a separate boiler at the back of the plant. This boiler is warmed by a fire or, if more convenient, with steam. The water can be heated to any required temperature, controlled by a large thermometer.

The interior of case O is divided by ten partitions into eleven compartments of equal size. The second, fourth, sixth, eighth and tenth of such partitions are fixed to the top of case O, while the first, third, fifth, seventh and ninth are fixed at the bottom. A long upper and lower series of binding rollers is supplied, by which the cotton material is caused to pass continually forward beyond the open space above the first partition, entering in the second compartment, where, after passing several times up and down and in the space below the second partition, it continues its zig-zag course forward, making its way out at S to rise to the projecting arms A and passing onto folding arrangement F, which forms pieces on the three iron trucks V.

Three pairs of round grooves are arranged on each of the binding rollers, placed always at the same distances. These serve to keep the tapes used for the entrance of the oiled fabrics always at the same distance, thus assuring their entrance at all times in a spread condition. Three pieces of oiled cotton cloth can be entered in the plant at G after passing spreading bars E under a regulated tension, a special frame being available on which the different rolls can be entered and taken out with the greatest ease. The whole plant is driven from an electric motor, gas engine or small steam engine at a speed easily regulated in each case by a small apparatus.

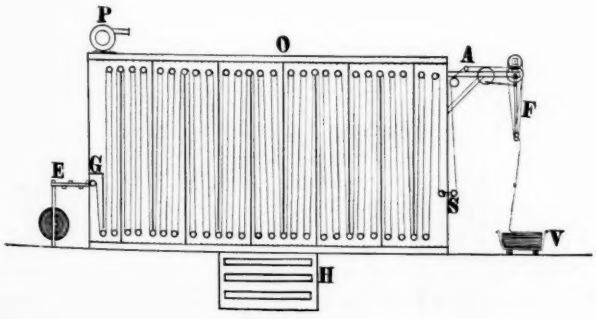

FIG 2.

OPERATION OF THE PLANT

For operating the above plant, the operatives enter three pairs of cotton tapes, which are caused to pass on all binding rollers and in the round grooves already indicated, one end left hanging on the spreading bars E and the other across the plaiting device F. At this point they sew to the ends of the pairs of cotton tapes the beginning of three of the oiled cotton fabrics to be dried. When this has been done, they prepare the hot water in the boiler already indicated, causing this to circulate through the long serpentine coil in heater H. A certain quantity of air is thus heated, and centrifugal pump P can be started to pump it upward through the double perforated ceiling. The temperature of the hot air is then controlled with a thermometer on the outside of oven O, reducing or increasing, if necessary, the quantity of cold air entered in heater H and passing in consequence through case O.

When the correct temperature has been reached in the interior of case O (about 55 deg. Cent.), the plant is started, the speed of the passage of the three pieces of cotton cloth being regulated in accordance with their thickness.

The material then makes its way forward, coming in contact with continually renewed hot air, from which the water vapors are withdrawn automatically, a very rapid drying resulting without exceeding the desired temperature and forming piece after piece on the three small trucks V, ready for delivery to the dyeing department. As each roll nears its end on the supporting frame in front of oven O, it is rapidly joined to the beginning of a fresh roll and in this way a large production is possible.

SPECIAL FEATURES OF THE PLANT

The above plant possesses the following advantages:

1. The hot air employed for the drying operations is divided into several lots, each of which dries the cloth separately.

2. The water vapors which are developed during the drying of the prepared oil solution on the cotton material are rapidly withdrawn in the upper space between the perforated double ceiling and the real ceiling, rendering more effective and rapid the drying operations.

3. By using hot water for the heating operations and regulating the quantity of cold air entered in heater H and in the mixing chamber, there is no danger of exceeding the required temperature.

4. The speed of passage of the three different lots of cotton cloth can be regulated at will and in accordance with their thickness and construction.

5. Should it be necessary, only one or two lots of cloth can be dried without bringing much difference.

A Modified Plant

The plant described in the foregoing could be modified, as shown in Fig. 3, for obtaining some special advantages.

Here is to be seen the light iron frame S, the lower portion of which contains special supports for sustaining the pairs of squeezing rollers B, C, D, E, F, G. The last of these receives the strong filtered dyestuff solution intended for the dyeing from two half-tubs at the back of the plant, one of which serves for its preparation and the other for its distribution. In this case the dye bath, after having filled the nip between the lower rollers of pairs G and F, passes from here to the nip formed between the lower rollers of the pairs F and E, and so on through the different nips which follow, until reaching the last nip formed between the lower rollers of pairs C and B, to be discharged from here into a lower collection trough, and returned by pumping into the preparation vat at the back of the plant, when it is strengthened and utilized for the dyeing operations.

The cloth is entered in this instance from the unwinding device A, under such conditions that it remains always under the desired tension, and after passing between the nip of cylinders B mounts to the exposal rollers H, passing down from here to the nip of rollers C, on the second series of rollers I, to the nip of rollers D, and so on, finally passing into the rinsing vat N, where a rapid stream of water, passed through in the opposite direction to that followed by the cloth, eliminates a good portion of the sulphide of soda, and all excess dyestuff, before passing between the squeeze rollers O to be batched up at R.

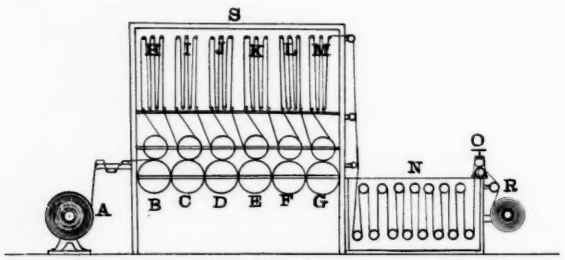

Fig. 3

Operation of the Plant

The plant is operated as follows: The cloth to be dyed is wound on a wooden beam and placed in the plant, sewing at the beginning a waste piece of cotton cloth, which has been passed through the whole of the plant and through vat N, where the rinsing water has been turned on. After the above, the strong dyestuff solution is prepared in the half-tub at the back of frame S and passed into the distribution half-tub and through the nips of the different pairs of squeeze rollers G, F, E, D, C, B, and from here into the collection trough already indicated.

The plant is then started and this carries forward the beginning of the first piece, causing it to receive six wettings, one after the other with intermediate oxidation before the squeezing on the series of exposal rollers H, I, J, K, L, M. After which the material is carried down into the rinsing trough N, to remove all excess coloring matter, and distributed ready for the further rinsing and soaping operations to be conducted on a separate plant. The old baths are used again as soon as possible in this case, after the necessary strengthening.

Advantages of the Plant

The above plant possesses the following special advantages:

1. The cloth, as it runs through the plant, is treated with fresh dyeing liquor, so that the final shade reached is quite clear and the brightest effects are possible.

2. The cloth comes at first in contact with the most exhausted portion of the dyeing liquid, and as it makes its way forward is treated in a bath with increasing dyestuff, taking up in this way the most intense shades, if these are required.

3. If the compartment above rollers B, C, D, E, F, G, is closed to form a chamber, and this is heated by any means, all water vapor developed being pumped out, the cloth can be partially or totally dried after each wetting, and is colored more deeply than would be possible by using the same dyestuff solution without salt on other plants.

4. Through the upper units of the pairs of squeeze rollers being smaller than the lower, there is no danger that the cloth can rub during its passage up and down in the plant.

5. The passage of the dyeing liquid in the different nips of rollers G, F, E, D, C, B, can be conducted at any speed in accordance with the shades produced and nature of the material treated.

OBJECTS OF A TEXTILE EDUCATION

Dr. Thomas Nelson, dean of the textile school of the North Carolina State College, recently declared that the training for young men going into the textile business should have two main objects: a thorough knowledge of the business and an acquaintance with men. To attain the first object, students taking the textile manufacturing and textile chemistry courses are taught the science and practice of carding, spinning, knitting, weaving, designing, dyeing and finishing of textiles.

They should secure up-to-date information about growing, grading, stapling and marketing cotton. Mechanical and electrical courses taught in an engineering school will give them a knowledge of heating and lighting problems.

The second object is attained by giving students a liberal education in mathematics, economics, industrial management, science, literature and languages.

AMERICAN
DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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INDIFFERENCE IN THE INNER CIRCLE

FIFTEEN stories above the din of traffic in Herald Square chemists are busily working in a laboratory. One is dipping samples of silk in a soap solution; another peers intently through a microscope at a wisp of fiber; a third studies the scale of a tensile strength tester. The laboratory has just been established by a famous department store—Macy's—for the purpose of testing the merchandise offered to its buyers. Its aim, according to the announcement issued by Macy's last week, will be "to promote more scientific buying by selection from competitive offerings of thousands of manufacturers, the merchandise representing best value per dollar." Like the Federal Bureau of Standards this laboratory should save the store thousands of dollars by providing facilities for buying materials according to specific standards of quality.

This setting up of a testing laboratory by a great city department store is not, in itself, a notable event. But it is significant as a sign of the times. It is but one more indication that the entire textile trade and industry is being stirred by a kind of restless urge or movement that was first felt several years ago and that has been rolling over the industry in waves ever since—an urge closely akin to the scientific spirit which possesses our mechanistic age of to-day; an urge best described as a strong desire for more scientific knowledge of textiles by all those who handle the products of the textile industry, and for standardization of those products.

To explain how this movement has advanced let us set up a figure or chart to represent the entire textile industry in all its branches—a figure something like a bull's-eye, of circles one within the other. In the center are the producers of the raw materials: the cotton planters and sheep ranchers, the raw silk filatures and the rayon industry. Around it, forming the innermost ring, are the textile mills of the country. Their processing departments should be kept especially in mind because there the urge for technical knowledge and standardization has been felt most intensely—though the means to satisfy it have been meager.

The next ring of our bull's-eye chart is made up of the wholesale groups, the apparel trades and other intermediate elements. Outside this ring is the circle of retail stores. Finally, the outermost ring is formed by the laundry and dry-cleaning trades.

Now, the movement that has created the testing and standardizing laboratories first stirred the inner circle of manufacturers, who were naturally brought into close touch with the technology of their products long before those in the outer circles, long before the apparel and consuming trades. But the idea that textile properties, such as color fastness, for instance, should be tested according to standards soon spread. It spread to the outer sectors of the industry. The idea made a splash like a stone dropped into water and once in motion it traveled in ripples to the outermost rim of the industry, through the rings of wholesalers and retailers to the dry-cleaning and laundry trades.

This movement, then, this urge for technical research (we have tried to avoid using that overworked phrase but let it stand) has manifested itself wherever textile products in any form are handled. The laundry trade and the cleaners and dyers, to start with the outermost ring, have been doing some very creditable, constructive research, the former group working at Mellon Institute, the latter at the Bureau of Standards. They have appointed staffs of chemists and technologists to study the technical problems of their respective crafts. Just within this active outer circle we find further activity among some of the retail stores, such as Filene's in Boston and Macy's in New York, who have, however, gone no further than the testing laboratory. The wholesale and apparel trades, which make up the third article, have organized a Joint Committee on Misbranding, and for technical assistance in establishing such *standards* as they require for color fastness tests, they have turned to the American Association of Textile Chemists and Colorists.

But constructive textile research of this type has not been pushed with equal vigor and intensity in every circle of the industry. The interest has not been everywhere the same. Some, like Macy's, have found that all they needed were standards of quality to help them buy efficiently; others have given their work a broader scope by carrying on research that will produce results of utmost value to the entire industry, such as the A. A. T. C. C. with its standardization of color fastness.

But where the technical research idea originated, among the mills, it has not been nearly so welcome as in the outer circles, which it touched later. In proportion to its resources and the bulk of its trade, the manufacturing sector of the industry, as we have pointed out in previous editorials, has not been sufficiently responsive in supporting the movement. Some of the larger mills do operate well-equipped testing and research laboratories and their studies have uncovered much invaluable data, have

produced results that can be measured in dollars and cents. Again, one or two well organized associations of technical men that have been persistent advocates of research have more than justified their efforts with some very material achievements.

These mills and technical associations have demonstrated beyond the shadow of a doubt that standardization and technical research are wholesome, strengthening elements essential to the future welfare of the industry, and that eventually the industry must support collectively some central agency which can supervise its research and bring its standardizing work into line with that of allied textile groups.

The significance of Macy's new testing laboratory is, therefore, that it illustrates, by contrast, the relative indifference of the inner circle to technical research and to standardization projects. It can be pointed out as a specific example of the alertness of the apparel and merchandising groups to that movement we alluded to, that desire to study and improve and standardize the quality of textile products and the processing of textile materials; a movement, as we have shown, that first welled up in the inner circle of textile manufacturing and then spilled over and spread out until it has touched every other sector of the industry.

The immediate danger is that the response to this important movement will be too strong in some branches of the industry and not sufficiently strong in others, that the *outside* circles will push their research and their standardizing more rapidly than the inner; that the mills will lag, will *follow* instead of lead, the consuming trades. To avert this danger the manufacturers must very soon act together to support and develop the existing technical research agencies in their circle. C. H.

THE SAFE LABORATORY

WHILE ordinary care will usually prevent most accidents on the street and in the home, extraordinary precautions are usually required in chemical laboratories, simply because the hazards here are increased by the presence of dangerous materials and apparatus.

A clean laboratory in which stocks of chemicals are properly stored, in which there is ample "elbow room" and in which processes and the handling of materials are strictly and methodically supervised, is a safe laboratory—as safe as one reasonably can be. But even with these ideal conditions, the unusual and unexpected can occur. The smallest error in calculation, the slightest misstep, may cause an accident. What the consequences of that accident may be cannot be foretold. It is likely to be painful to someone and to reduce for an uncertain period the efficiency and productive capacity of the injured worker.

The findings of safety experts show that a large percentage of accidents are avoidable, and that they are more frequently caused by someone taking a chance rather than by gross ignorance. A thoughtful reading of the article in this issue on "Prevention of Accidents in Chemical Laboratories" by all those who work in laboratories or who supervise such work is recommended.

MAKING INDUSTRY SAFER

IN connection with the subject of safety in the laboratory the work of the National Safety Council in promoting industrial safety in general should be mentioned and praised. The following resolution was drawn up and presented before the Council's sixteenth annual Safety Congress held last week in Chicago:

Whereas, Some twenty-four thousand workers were killed and hundreds of thousands were injured in industry during 1926, causing pain, sorrow, destitution, interruption of orderly processes, slowing up of production and the economic loss of billions imposed upon employers and employees; and

Whereas, More than forty-three hundred employers, members of the National Safety Council, have demonstrated that most accidents can be prevented through organized prevention work; and

Whereas, It has been demonstrated, by members of the National Safety Council, that this achievement is possible in all fields of industrial endeavor, if all employers and employees will realize that accident prevention is a responsibility which should be shouldered by everyone; therefore, be it

RESOLVED, That the members of the National Safety Council and others deeply concerned, assembled in Chicago, Ill., at the Sixteenth Annual Safety Congress, urgently recommend the following:

1. That all employers make a survey of their respective establishments, both large and small, to ascertain the why, where and how of accidents and accident prevention.

2. That employers keep and analyze their accident records for the purpose of devising ways and means of preventing the recurrence of accidents.

3. That employers safeguard, in so far as possible, all mechanical equipment or revise manufacturing processes so as to eliminate these hazards.

4. That the personnel of all establishments be impressed with their individual need of safety and with the necessity of properly instructing their fellow-workers in Safe Practices.

5. That employers support efforts being made by community safety councils, the National Safety Council, Federal, State and municipal officials and others, by conducting necessary organized accident prevention campaigns

6. That employers encourage the inclusion of safety education in the courses of public, private and parochial schools and colleges.

7. That more colleges and universities incorporate safety engineering in existing engineering courses.

CORRESPONDENCE

Editor, AMERICAN DYESTUFF REPORTER:

In your issue of September 5 you publish a communication from a reader under the caption, "What Shall We Say and Write," and in the same issue you make editorial comments on this communication at the same time offering some definite suggestions which cannot fail to be of value to those preparing papers either for reading at the meeting of the technical society or for publication. As Chairman of the Committee on Technical Program for the next Annual Meeting of the Association I would like to make a few further comments on the communication previously referred to.

In the first place the ruling made this year for the first time by the Council of the Association that requires all papers to be submitted so that they can have some preliminary scrutiny, is made with but one object in view and that is that the program at the Annual Meeting shall be as interesting as possible to the greatest number and at the same time shall cover as great a variety of subjects as is possible or advisable in one day. It is, I think, recognized by all that our one-day sessions have come to be pretty short for the amount of material that we try to digest. The result is that unless considerable planning is done in advance we find ourselves with the entire time taken up in the presentation of papers themselves and with no time at all available for discussion. Personally I believe that very often the discussion provoked adds very materially to the value of the original paper presented and the necessary limitation of discussion based purely on lack of time is something that we ought to avoid if it is at all possible to do so. The foregoing explains, I think, the view of the Council in the matter and makes plain why this year's requirements as to submission of papers was put into effect. It is quite conceivable that there will be cases where the authors of a paper will be requested to present the high lights of their subject at the meeting personally and in enough detail so that the subject matter can be intelligently discussed and then the full paper to be published later in the Proceedings. This will not necessarily be the procedure, but if we have a large amount of material that we would like to get into the program this is about the only way that we can do it.

There is one more point in the communication from a reader which has to do with the more scientific material. Certain it is that in our Association there is and can be no frowning upon highly scientific matter. All such matter is most welcome and highly desirable. It is also true that matter of this nature must often be presented in a good deal of detail and at rather great length so that it can easily take much more than the average time allotment if it is to be adequately presented. It would seem that the best procedure in such a case would be to use the full time allotment in presenting the full outline and as much of the detail as possible, and then have the matter published in its entirety in the Proceedings.

Yours very truly,

ELVIN H. KILLHEFFER.

THE CHEMICAL INDUSTRIES EXPOSITION

In the Eleventh Exposition of Chemical Industries held in New York during the week of September 26, the man in the street, the professional chemist and the executive were treated to one of the most amazing and impressive displays of industrial activity that have ever been staged. There is no more effective way to present the complete story of an industry so ramified as the chemical industry than a public exposition of its products, and as an educational spectacle of industrial progress this year's chemical show was a brilliant success.

The exposition occupied three full floors of the Grand Central Palace in New York. About 375 separate exhibits presented as in a panorama the entire chemical industry with all its branches. It was a colossal living picture of what has been achieved in the mechanization of chemical manufacturing and what has been achieved by chemistry as a science. But mechanical equipment, while the center of interest by sheer force of numbers and size, did not comprise all of the most interesting and important exhibits. The smaller displays of chemical materials and apparatus attracted a large proportion of the crowds of visitors that filled the aisles and booths during every day and evening of the show.

Most of the chemical machinery and equipment on display was in operation. Mixers, separators, sifters, centrifugals, pulverizers, crushers, dryers, valves, stone and glass ware, and laboratory apparatus turned the exhibition halls into a mammoth chemical plant in full operation.

The relation of chemical science to textile manufacturing was repeatedly illustrated by the exhibits of rayon manufacturing apparatus, dyestuffs and mill chemicals, and general laboratory equipment. But most educational from the standpoint of the textile chemist were the extensive exhibits of various Government departments and bureaus serving the chemical and textile industries. A large space on the third floor was devoted to displays of the work of the U. S. Department of Commerce, with its Bureau of Standards and Chemical Division; of the Department of Agriculture, and of the Chemical Warfare Service.

The Bureau of Standards display included an exhibit showing the proposed classification of the fastness of colored textiles. Samples of dyed cloth that had undergone fading tests were shown, with their fastness to both light and washing classified according to the standards proposed recently to the Joint Committee of the Textile Industry on Misbranding. Another exhibit in this bureau's display showed studies

of hosiery defects caused by acid burns. Rather interesting to textile men also was the exhibit, in the booth of the Chemical Warfare Service, of a moth-destroying process for fabric warehouses that uses as a fumigating agent hydrocyanic acid gas.

The booth of the American Chemical Society, occupying a large space on the first floor, was the headquarters for members visiting the show, and also contained some impressive displays of the latest chemical novelties—viscose sausage casings, a new carbon dioxide gas refrigerating system, and similar recent products of chemical science.

Because foreign exhibitors were admitted this year for the first time some slight apprehension was felt in the trade that their displays might compete too strongly with those of American manufacturers. Foreign products on exhibition were greatly in the minority, however, and certainly could not be said to have been too obtrusive. If anything, they contributed appreciably to the interest of the show and should be welcome at the succeeding expositions.

THE CHEMICAL INDUSTRIES DINNER

The dinner held at the Hotel Roosevelt on Wednesday evening, September 28, was a gathering of the most prominent figures in the American chemical industry, as well as of a number not so noted except for their intimate and active association with one of the greatest industries in the country. More than 500 men attended this dinner, which was broadcast by radio.

The Hon. Nicholas Longworth, who was to be the principal speaker of the evening, was unfortunately unable to be present, but the other speakers on the program and those secured at the last moment to take Mr. Longworth's place were very heartily received by the audience.

C. C. Concannon, head of the Chemical Division of the Department of Commerce, who has just completed a first-hand study of the European industrial situation, declared that his survey had convinced him that Germany, France, England, Italy and Japan have become very formidable and powerful competitors of this country for the chemical trade of the world. To keep abreast of the advances made abroad in chemical manufacturing, he said, the chemist of this country needs a stronger "international economic sensitiveness." He emphasized the important factor of closer teamwork in the chemical industry.

Even darker prophecies were made by another speaker, E. M. Allen, president of the Mathieson Alkali Works, who blamed the Sherman anti-trust law and similar legislation for the present situation in our chemical industry. Such legislation, he declared, restricts the industry and prevents it from coping with foreign competition. Asserting that the Sherman law is obsolete, Mr. Allen further told the gathering that "because of it and other laws of its kind we are not equipped to supply industrial demands, as are many foreign countries. We must prepare to fight. It will be up to us to get the Government behind us and bring about many changes in existing laws."

Dr. John Teeple, treasurer of the American Chemical Society, who presided as toastmaster at the Chemical Industries dinner, briefly reviewed the tariff struggle between the United States and France, and suggested that this Government use its power to raise the present tariff provisions to meet France's recent increases.

SILK DYERS WORK TOWARD BETTER RELATIONS WITH MANUFACTURERS

A determined effort to improve their trade relations with the silk manufacturers will be made by the dyers of Paterson working as a group under the banner of the Paterson Piece Dyers' Protective Association, which was recently reorganized.

The immediate plans of the association were outlined at a dinner held a short time ago in Steuben Hall. It was announced that an executive business manager will be appointed to represent the interests of its members and direct the plans proposed to foster more harmonious relations between the dyers and the manufacturers. Under the association's reorganization plan a credit bureau will be established through which dyers may obtain reliable news and information regarding trade conditions and practices and to which they may turn for assistance in cases of unfair treatment, such as the entrance of an unjust claim.

The dyers of Paterson, large and small, whose total investment reaches beyond the $50,000,000 mark and whose industry is conceded by the chamber of commerce to be the backbone of the city, were represented by fifty of their number at the meeting, at which Lawyer Henry Smith, president of their protective association, presided. The reorganization plan, declared President Smith, is the outcome of the chaotic condition of the silk dyeing and finishing industry.

"Dyers," he said, "have come to the conclusion that drastic steps, such as have been taken, were absolutely necessary in order to permit the industry to continue on a sound basis. Large or small, they all agree on this point, and inasmuch as the dyeing and finishing industry is the backbone of the city, we feel that our action of to-night will go down in the history of the city as one of its greatest civic movements and that it will restore the health of the industry.

"Fair treatment is all that is asked by the dyers and finishers, who realize that the customer needs the dyer as much as the dyer needs the customer."

The association, which was organized in 1920, was unable to state exactly when the proposed business manager will be appointed or who he will be, but definite information on this subject was promised as soon as the necessary negotiations have been completed. It was stated that who-

ever is selected will be a man of excellent executive ability who will be in no way connected with the dyeing industry. With such a man in that position, it was pointed out, the dyers will have one in whom they can place their confidence in going to him in quest of fair treatment with a customer who has acted unfairly.

Officers of the association also pointed out that a credit bureau is something the dyers of Paterson have sorely needed for many years.

DU PONT LOOKS BACK OVER A CENTURY AND A QUARTER

The most notable advances in chemical manufacturing science in America are surveyed in a series of articles published in the September number of the Du Pont Magazine, for this year E. I. du Pont de Nemours & Co. are celebrating their 125th anniversary.

The part taken by the Du Pont interests in the development of the American rayon industry is surveyed by L. A. Yerkes, president of the Du Pont Rayon Company, Inc.

Taking as his subject "Du Pont's Contribution to the Textile Industry," Mr. Yerkes interestingly tells of the firm's entry into the making of rayon and briefly sketches the remarkable development of rayon manufacturing in the United States. By way of introduction he states: "When Chardonnet first produced a silk-like fiber by chemical means in 1884 and organized a company for its manufacture in France, he founded an industry that was destined to grow to astounding proportions. For years its manufacture was confined almost entirely to Europe. Even as late as 1910 there was practically no production and little consumption of this yarn in America. Two years later, however, domestic production had passed the million-pound mark, and recent statistics show that in 1926 the United States led all other countries in the manufacture of rayon with an output of nearly sixty-two million pounds."

Dyestuff Achievements

A valuable contribution to the history of the American dyestuffs industry is made in the article "The Achievements of a Decade in the Dyestuffs Business," by E. G. Robinson, assistant general manager of the dyestuffs department of the Du Pont company. "The Du Pont dyestuffs industry, into which the company was led during the World War," says Mr. Robinson, "has now reached a stage of development where it can supply the consuming industries of the United States with a large percentage of their needs." Mr. Robinson recalls the early days of the war, when it was reported that dyestuffs were becoming scarce. "People were led to believe that we would all be forced to wear white clothing," he writes. "Due to the foresight and enterprise of the Du Pont company and other companies which undertook the creation of a dyestuffs industry in this country, the catastrophe . . . was happily averted."

Mr. Robinson presents many interesting facts concerning the part Du Pont has played in making American textile manufacturers and other users of dyes independent, in large measure, of foreign sources of supply.

Another very informative contribution to this anniversary number of the magazine is the article by

The United States Was Young When the Du Pont Company Was Founded. A Map Issued to Commemorate the 125th Anniversary of the Du Pont Interests.

Dr. Charles M. A. Stine, chemical director of the Du Pont company. The writer tells of the vital part chemistry plays in American industries, especially one of the diversified chemical manufacturing character of the Du Pont company.

CHARLES S. TANNER

Charles S. Tanner, president and treasurer of the Charles S. Tanner Company, Providence, R. I., manufacturers of starches, dextrines and glues, was stricken in his office and died on August 29.

Mr. Tanner, who was seventy-five years old, had been connected with the business on South Water Street, Providence, for more than half a century. He was at first associated with Orray A. Taft, Jr., and later assumed control of the business under his own name.

Mr. Tanner was born in Centerville, but lived the greater part of his life in Providence and Cranston. He was active in the civic affairs of Cranston, having been for several years a sinking fund commissioner of the city.

CAROLINA COLLEGE OPENS NEW TEXTILE LABORATORY

A modernly equipped experimental laboratory for the exclusive use of the textile manufacturers of North Carolina has recently been established by the textile school of State College. The new laboratory is set apart from the school itself, so that there is no interference between students and the manufacturers' chemists in the course of experimental work on various phases of cotton technology. During the summer the laboratory has been constantly used by some of those interested in the commercial production of cotton products in North Carolina.

NATIONAL ISSUES NEW DIRECT GRAY

As an important addition to its line of fast-to-light direct dyes the National Aniline & Chemical Company has announced the production of National Solantine Gray GL Conc. This color is described as characterized by excellent fastness to light and good fastness to washing, sea water, perspiration, alkali, acids and crocking. It possesses very good solubility, according to the announcement, and will be noted for its level dyeing properties. It is adapted for application in all types of Monel-metal machines.

National Solantine Gray GL Conc., it is further stated, is as suitable for dyeing rayon as for dyeing cotton, and is recommended for use alone or in combination for producing a variety of shades. Not possessing affinity for animal fibers, it may be used to advantage for silk white effects.

ATTRACTIVE SHADE CARDS ISSUED BY GENERAL DYESTUFF

Some of the most recent products of the I. G. Farbenindustrie-Aktiengesellschaft are attractively displayed in seven new shade cards recently issued by the General Dyestuff Corporation of New York, American importers for the German firm.

These new cards contain swatches showing the Supramine colors on piece goods, the Supramine colors on woolen yarn, the Fastusol dyes on cotton piece goods, current shades on cotton piece goods produced with Dianil and Thiogene series of colors, print-on styles on cotton, colors for garment dyeing, and aniline dyes on jute yarn.

The Supramines are a special group of acid dyeing wool colors described as notable for fastness to washing, milling and light and for resistance to the alkaline action of dust. The shades in the pattern card illustrate their application to men's and women's wear. The piece goods card shows twenty different shades and gives percentages for each.

The Fastusol colors are recommended, in the pattern card for that series, for use on goods which are not required to possess the general fastness of the Indanthrenes and for which an inferior degree of fastness to washing will suffice, such as curtains, upholstery cloth, etc., where unusual light fastness is called for.

The card showing the Dianil and Thiogene dyes contains 120 swatches in an exceptionally wide variety of shades produced with single colors of the series and with combinations on different grades of cotton goods.

Some interesting prints are displayed in the well-designed card containing the swatches of directing printing on cotton. The designs were produced with the Brilliant Indigo and Alizarine Indigo brands, for which complete printing recipes are given.

The Garment Dyeing Card is in the form of a technical book on the subject, with dyed swatches and bows attached to the text pages. Its contents cover the washing and stripping of goods prior to dyeing and the dyeing of all classes of fabrics in garment form, the colors suitable for each class being listed in the text.

The jute yarn shade card displays nearly one hundred different shades on mounted swatch bows of jute, and, as in the case of the other six cards, dyeing directions for the colors are given in the text matter attached to the cover.

The Industrial Dyeing Company, Inc., of New York, has purchased the plant of the Dexter Rayon Dyeing Corporation, at Pawtucket, R. I., and will operate it under the name Industrial Dyeing Company of Rhode Island. Leon McKenzie, treasurer of the Dexter corporation, goes with the Industrial as treasurer.

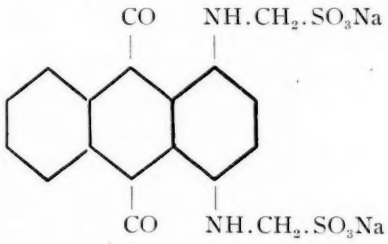
RECENT PATENTS

Process for the Manufacture of Anthraquinone Derivatives

(1,636,485; July 19, 1927)

William Henry Perkin, Oxford, and Alexander Walker Fyfe and Mordecai Mendoza, Manchester, England, assignors to British Dyestuffs Corporation, Limited, Manchester, England.

As a new product, the substance having the structural formula



Process for Extracting Fats from Textiles

(1,636,351; July 19, 1927)

Albert Beil, Hochst-on-the-Main, and Wilheim Adolf Meyer, Hersfeld, Germany, assignors to A. Rechberg Gesellschaft mit beschrankter Haftung and Georg Braun Gesellschaft mit beschrankter Haftung, Hersfeld, Germany.

In a method of defatting textiles by means of volatile solvents, the step of treating such textiles with liquid methylenechloride.

Process for Preparing Water-Softening Materials

(1,636,942; July 26, 1927)

George W. Prather, Des Moines, Iowa.

The process for forming a filtering and water softening material which consists of drying a mineral having for its base a hydrated silicate of aluminum until practically all the uncombined moisture is driven off, reducing such mineral to particles of suitable size by mechanical means, then baking such mineral at a high temperature in the presence of sodium hydroxide (NaOH) until the hydroxide melts and thoroughly permeates the mineral and the particles are rendered hard and finally washing the mineral free of excess sodium hydroxide.

Manufacture of Nitrated Cellulose from Wood Pulp

(1,641,292; September 10, 1927)

Victor Planchon, Lyon, France.

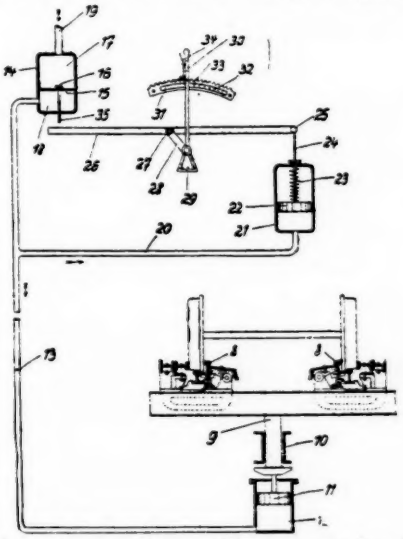
A process for manufacturing nitrated cellulose from wood pulp, comprising the steps of immersing thick wood-pulp sheets of low porosity in a nitration bath the temperature of which is below 15 deg. Cent., but not less than 5 deg. Cent., and maintaining said bath at a constant temperature during the whole period of nitration, such period varying according to the temperature of the bath.

Fluid-Pressure Regulator

(1,635,989; July 19, 1927)

Ernst Frolich, Essen-on-the-Ruhr, Germany, assignor, by mesne assignments, to the Hannauer Car Retarder Company, Chicago, Ill., a corporation of Illinois.

In an apparatus for controlling the fluid pressure: a combination of a fluid container having a supply of pressure fluid to the container, with an operating lever arranged outside and independent of the said fluid container, but adapted to control the fluid regulating means, and an adjustable hand lever hinged outside of the fluid container and adapted to shift the fulcrum of the said operating lever, a cylinder separated from or communicating with the said fluid container, and a spring pressed piston within said cylinder, and connected with the said operating lever.



Black Sulphurized Naphthol Dyes

(1,641,182; September 10, 1927)

Charles Henri Marschalk, Paris, France. Filed March 11, 1924, Serial No. 698,568, and in France March 16, 1923. 7 Claims. (Cl. 260—20.)

Black vatting dyestuff, obtained by the action of an alkaline polysulphide on a condensation compound obtained by the reaction of an anhydrous chloride which is a reducing agent upon an hydroxy-naphthalene derivative.

Process of Treating Paper

(1,641,478; September 10, 1927)

Dozier Finley, Berkeley, Calif., assignor to the Paraffine Companies, Inc., San Francisco, Calif, a corporation of Delaware.

The process of treating a formed wet sheet of paper which comprises displacing water normally present therein with an aqueous solution of a salt.

Technical Notes from Foreign Sources

Hydrosulphite Vat for Wool

Various processes are available for dyeing wool in the hydrosulphite vat; for example, the hydrosulphite soda vat, the hydrosulphite lime vat, the bisulphite zinc lime vat, etc. These vats are suitable only for Indigo, but the ammonia gelatine vat can also be used on the wool vat colors. Indigo is itself also dyed with this vat.

The hydrosulphite lime vat differs from the soda vat in that caustic lime is employed in the place of caustic soda. Wool is known to be very sensitive to the action of caustic soda and other alkalies, but caustic lime has not so strong an action on wool. On the other hand, the addition of the lime must be made strictly according to directions, for when too little lime is present Indigo white is precipitated and when too much is present the absorption of the dyestuff by the fibers is retarded, the material becomes brittle and difficulties are accordingly encountered in its spinning. Another disadvantage is that a deposit is formed in the vat.

In the bisulphite-zinc-lime vat the hydrosulphite is made by the dyer himself mixing together zinc dust and sodium bisulphite. Caustic lime is added in order to dissolve the Indigo white. The same dangers are present in this process as in the lime vat process, with the exception that they are more emphasized, as it is more difficult to attain the limit of alkalinity, due to the fact that the mixture reacts acid from the bisulphite and zinc, and hence more caustic lime must be added. The required amounts of bisulphite, milk of lime and Indigo are mixed with water, and then, while being vigorously stirred, zinc is added. The mixture is allowed to remain standing until the odor of sulphur dioxide has disappeared and the solution becomes a clear yellow.

The hydrosulphite-ammonia-gelatine vat is the best of all. Indigo, as well as other wool vat colors, can be dyed by this method. The dyestuff is made up into a paste with the aid of a little Turkey Red oil or other sulphonated soap, which means dyestuff and oil are intimately mixed. Then the required amount of caustic soda solution is added. The mixture is stirred, the necessary amount of water at a temperature of 50 to 60 deg. Cent is added and the entire mass is well stirred. The weighed amount of hydrosulphite is then added in portions and the mixture is again warmed up to the aforementioned temperature. The addition of the dyestuff is made after a period of twenty to thirty minutes has elapsed. It is easily seen that the liquid has a different color than the foam that is formed on its surface, the latter having the color of the finished dyed material. The liquid must not contain any undissolved dyestuff.

The liquid is now ready for use. If it becomes turbid after standing thirty minutes, then additional quantities of sodium hydroxide solution must be added. If particles of undissolved dyestuff are present, then more hydrosulphite must be added in order to dissolve them.

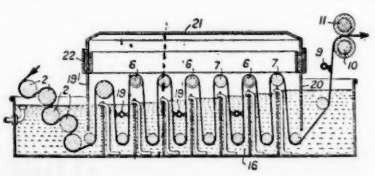
In the meantime the vat is itself mixed with the necessary amount of water and warmed. Some ammonia is added and the water therewith becomes alkaline and the hydrosulphite is strewn over the surface, which renders the atmospheric oxygen harmless; that is, that which is in the water. The gelatine or glue is then added. The gelatine, at best an animal gelatine, is made up into a solution with water in the proportion of one to ten. The vat is now ready to be used.

The wool is worked around under the liquor, the operation being carried out with all care. After thirty to forty minutes the wool is removed, squeezed and then allowed to hang or oxidize. The squeezing must be rapidly effected so that no non-fixed dyestuff remains on the fiber. The oxidation of the leuco dyestuff or Indigo white, for example, produces the actual color tone. Instead of the material turning green in the air, it is also possible to draw it through a sodium peroxide liquor, which accelerates the oxidation.

The goods are then strongly washed in order to remove the non-fixed dyestuff. If the washing is not carefully carried out, the color will rub. The material is drawn through a bath containing dilute sulphuric acid, whereby the color tone of the wool dyestuff becomes distinctly clearer. This treatment is absolutely necessary in certain instances in order to obtain a fine color. The process is then ended by subjecting the textile to repeated, thorough washing. (Deutsche Faerber Zeitung, Vol. 62, pp. 593-594.)

Mercerizing Fabrics

In an apparatus for washing mercerized fabrics, in which the fabric passes, in counterflow to the washing liquid, through a number of compartments 16 protected by a liquid seal, the web is led over upper rollers which are above the level of the liquid and comprise alternately smooth rollers 7 driven at the speed of the



web and ridged or right and left hand threaded breadth-stretching rollers 6 driven at a different speed so as to scrape the liquid off the web. The fabric passes over curved breadth-stretching rollers 2, the last of which are submerged, to the compartments within a steam chamber formed by walls 19¹, 20 and a cover 21, which cover has a liquid seal 22, and is finally sprayed at 9 with the fresh water supply and squeezed by rolls 10, 11. Steam is injected at 19 to heat and agitate the washing bath. (British Patent No. 262,343.)

Determining Sulphuric Acid in Wool

The new method for determining sulphuric acid in wool is based on the observation that when wool is placed in an aqueous solution of sodium terephthalate the latter will react quantitatively with the acid present in the wool with the precipitation of insoluble terephthalic acid. The application of the method is described in detail as well as numerous practical experiments made with it. (Journal of the Textile Institute, pp. 101ff, 1926.)

Action of Lead Oxide on Dyestuffs

Hydrated lead monoxide shows no tendency to absorb basic dyestuffs, neither dyeing of the oxide nor formation of precipitates taking place with such colors as Methylene Blue, Safranine T, Methyl Violet 10B or Toluidine Blue. When the oxide is brought into contact with such acid dyestuffs as Disulphine Green T and Patent Blue, it is found that the oxide is uniformly dyed without the formation of precipitates. The absorption curves obtained in these cases by plotting the amount of dyestuff that remains in solution against the amount that is absorbed by the solid have a more or less well-defined resemblance to ordinary adsorption isotherms.

In the case of Patent Blue it was found that a sample of the oxide containing 6.12 per cent of moisture and prepared by precipitation of the lead salt with a minimum amount of alkali always adsorbed more dyestuff than a sample whose moisture content was 4.62 per cent and that was prepared by precipitation with a large excess of sodium hydroxide.

While the difference in adsorption powers may be partly due to the difference in moisture content, it may also be due to the presence of adsorbed alkali in the second sample, which would consequently be more electronegative than the first sample.

With other acid dyestuffs—for example, Methyl Orange, Orange II, Bordeaux B and Orange IV—less regular results were obtained. The dyeing of the oxide was accompanied by the formation of a considerable amount of flocculent precipitate above the layer of hydrated oxide. Bordeaux B was removed in approximately constant amount, this being independent of the concentration of the dye solution. Orange II was completely removed from its dilute solution by the lead oxide samples, which has a moisture content of 6.12 per cent. It is probable that absorption is accompanied by more or less chemical combination, and the compound that is obtained, which is probably the lead salt of the dye acid, itself absorbs a further amount of the dyestuff. The absorption curves in these four cases represent a resultant of the various processes. (Journal of the Society of Dyers and Colorists, 1927, 43, pp. 192-194.)

Printing Pastes

It is found that in many cases the glycerine, acetin and other products that are added to the printing paste to act as solvents of the organic dyestuffs do not give satisfactory results in the printing of textile fabrics. On the other hand, the printing pastes made with the addition of such substances as ethylene glycol and ethylenechlorohydrin give remarkably fine printed designs. These are much clearer and more permanent than the prints that are obtained with color paste containing the usual additions and used in the ordinary manner. The use of the ethylene derivatives permit the preparation of printing pastes free from acid that do not attack the textile fiber and that may be used with particular advantage in the printing of weighted silk. Ethylene glycol in the printing paste enables the attainment of good results in discharge and reserve printing. It may be used with advantage in replacing such substances as acetin, glycerin, phenol, aniline oil and alcohol. It allows very intense shades to be obtained on the printed goods without there being any danger that the strength of the textile fiber will be impaired in the treatment, and this refers again particularly to printing weighted silks.

An example illustrating the use of these substances in the printing paste is as follows: Four grams of Chrome Azurol S Conc., for example, are dissolved in 26 grams of water. Then 8 grams of ethylenechlorohydrin are added, as well as 54 grams of starch and gum tragacanth thickener and 8 grams of chromium acetate of 20 deg. Be. concentration. This mixture is used in printing weighted silks, the color being fixed by steaming after printing and the fabric being finally washed. (French Patent No. 587,269.)

Bleaching Solution

French Patent No. 586,796 is concerned with the preparation of a solution that can be used for a variety of purposes in textile fibers. This preparation is made by the chlorination of trisodium phosphate or other phosphates, such as the orthophosphate, the metaphosphate or the pyrophosphate. When these substances are dissolved in water, a solution is obtained which can be used in bleaching textiles, to remove ink stains, fruit stains and the like.

The active substance is made in the following man-

ner: An aqueous solution is first made containing 3 per cent of trisodium phosphate by weight and then a stream of chlorine gas is passed into the solution until the amount of chlorine absorbed by the phosphate is equal to 1 per cent of the weight of the solution. A product of this character which is used in the diluted condition does not soil the textiles and does not turn yellow the paper on which it is used for the purpose of removing ink. The preparation may be made in such a manner that it contains from 1 to 6 per cent of trisodium phosphate and from ¼ to 1 or 2 per cent of chlorine.

TROUBLE IN CHINA CUTS INDIGO DYE IMPORTS

The large decrease in China's imports of artificial Indigo and dyestuffs in 1926 was undoubtedly due to the trouble in the country. The following figures are from the Annual Report of Commerce and Industries, Hankow, China:

	1925		1926	
	Pounds	Gold $	Pounds	Gold $
Aniline dyes	.....	$401,708	.....	$206,360
Indigo:				
Artificial, dried.....	66,133	42,180	93,067	42,221
Artificial, paste.....	11,472,000	2,551,275	6,913,867	1,256,775
Dyestuffs	221,600	25,200	31,067	5,270

A recent proclamation forbids the importation into Australia of all synthetic organic dyestuffs or colors other than of British origin, unless the Minister for Trade and Customs has given his consent in writing.

Borne Scrymser Company has declared extra dividend of 75 cents a share and the regular quarterly of $1 a share, payable October 15 to holders of record September 23. An extra dividend of the same amount was declared six months ago.

Duncan Ferguson, former superintendent of the East Webster (Mass.) plant of the Slater Company, Inc., has accepted a similar position with the Textileather Company, Toledo, Ohio. Oscar H. Forsdale and Carl Round, also formerly of the same plant, have gone with him.

Declared exports from Hamburg, Germany, to the United States for the June quarters of 1926 and 1927, were respectively: Chemicals, coal tar products, $35,161 and $196,960; chemicals, medicinal and pharmaceutical, $40,445 and $66,922. The information is supplied by Consul T. H. Bevan, of Hamburg.

Sturbridge Printing & Finishing Company, Fiskdale, Mass., is to start work this week rebuilding the dam at Long Pond in that village, which was washed away in a freshet in February, 1914. The company will use the water to operate the plant, the present supply being inadequate.

Diamond Silk Dyeing & Finishing Company, West New York, N. J., has been required to discontinue temporarily the erection of its proposed one-story addition, 100 by 100 feet, on Johnson Place, owing to protest of property owners. A court hearing has been scheduled for September 26; meantime, the Board of Health, it is stated, will make an investigation to determine details of the project. Contract recently was let for the structure, which is estimated to cost $50,000.

John Redstone has resigned as chemist for the Eaton Knitting Company, Hamilton, Ont., Canada, and accepted a similar position with the Dominion Silk Dyeing & Finishing Company, Drummondville, Quebec.

Albert J. Malley, for several years overseer of finishing at the Washington Mills of the American Woolen Company, Lawrence, Mass., has been made general superintendent of the cloth departments of that plant. His duties include general supervision of the dressing, weaving, mending, finishing and dyeing departments. Mr. Malley has been connected with the American Woolen Company for the last fifteen years.

Schlatter Dyeing Company, Philadelphia, Pa.—Contract for the erection of a mill building at Rorer Street, south of Ontario, has been awarded by this company to F. Crompton & Co., builders, to cost $20,000.

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i. e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

DYESTUFF CHEMIST

Dyestuff chemist, 34, married; over ten years' experience, six years in charge manufacturing meta and para toluylenediamine, Naphthol Green, azo colors and intermediates; also some vat color experience; desires permanent connection with chance of advancement commensurate with ability. Salary $50. Address Classified Box 410, American Dyestuff Reporter.

EXPERIENCED DYER

Experienced textile chemist and dyer, especially qualified in the dyeing of worsted tops, yarns and pieces, desires position as dyer or dyer's assistant. Address Box 419, American Dyestuff Reporter.

DYER WANTED

Wanted—Dyer absolutely experienced in the dyeing of cotton yarns in sulphur and Indanthrene colors on Franklin machines. Address Classified Box 420, American Dyestuff Reporter.